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Programmable Logic Controller

Analog I/O Module

XGT Series

User's Manual

XGF-AH6A

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LS Industrial Systems

Before using the product …

For your safety and effective operation, please read the safety instructions thoroughly before using the product.

- Safety Instructions should always be observed in order to prevent accident or risk with the safe and proper use the product.

- Instructions are divided into “Warning” and “Caution”, and the meaning of the terms is as follows.

⚠ **Warning**	This symbol indicates the possibility of serious injury or death if some applicable instruction is violated
⚠ **Caution**	This symbol indicates the possibility of severe or slight injury, and property damages if some applicable instruction is violated

Moreover, even classified events under its caution category may develop into serious accidents relying on situations. Therefore we strongly advise users to observe all precautions properly just like warnings.

- The marks displayed on the product and in the user’s manual have the following meanings.

  ⚠ Be careful! Danger may be expected.

  ⚠ Be careful! Electric shock may occur.

- The user’s manual even after read shall be kept available and accessible to any user of the product.

Safety Instructions for design process

⚠ Warning

- **Please install a protection circuit on the exterior of PLC so that the whole system may operate safely regardless of failures from external power or PLC.** Any abnormal output or operation from PLC may cause serious problems to safety in whole system.
  - Install protection units on the exterior of PLC like an interlock circuit that deals with opposite operations such as emergency stop, protection circuit, and forward/reverse rotation or install an interlock circuit that deals with high/low limit under its position controls.
  - If any system error (watch-dog timer error, module installation error, etc.) is detected during CPU operation in PLC, all output signals are designed to be turned off and stopped for safety. However, there are cases when output signals remain active due to device failures in Relay and TR which can't be detected. Thus, you are recommended to install an addition circuit to monitor the output status for those critical outputs which may cause significant problems.
- **Never overload more than rated current of output module nor allow to have a short circuit**. Over current for a long period time maycause a fire .
- **Never let the external power of the output circuit to be on earlier than PLC power**, which may cause accidents from abnormal output oroperation.
- **Please install interlock circuits in the sequence program for safe operations in the system when exchange data with PLC or modify operation modes using a computer or other external equipments** Read specific instructions thoroughly when conducting control operations with PLC.

Safety Instructions for design process

⚠ Caution

- **I/O signal or communication line shall be wired at least 100mm away from a high-voltage cable or power line.** Fail to follow this

Safety Instructions on installation process

⚠ Caution

- **Use PLC only in the environment specified in PLC manual or general standard of data sheet.** If not, electric shock, fire, abnormal operation of the product may be caused.
- **Before install or remove the module, be sure PLC power is off.** If not, electric shock or damage on the product may be caused.
- **Be sure that every module is securely attached after adding a module or an extension connector.** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused. In addition, contact failures under poor cable installation will be causing malfunctions as well.
- **Be sure that screws get tighten securely under vibrating environments.** Fail to do so will put the product under direct vibrations which will cause electric shock, fire and abnormal operation.
- **Do not come in contact with conducting parts in each module**, which may cause electric shock, malfunctions or abnormal operation.

Safety Instructions for wiring process

⚠ Warning

- **Prior to wiring works, make sure that every power is turned off.** If not, electric shock or damage on the product may be caused.
- **After wiring process is done, make sure that terminal covers are installed properly before its use.** Fail to install the cover may cause electric shocks.

⚠ Caution

- **Check rated voltages and terminal arrangements in each product prior to its wiring process.** Applying incorrect voltages other than rated voltages and misarrangement among terminals may cause fire or malfunctions.
- **Secure terminal screws tightly applying with specified torque.** If the screws get loose, short circuit, fire or abnormal operation may be caused. Securing screws too tightly will cause damages to the module or malfunctions, short circuit, and dropping.
- **Be sure to earth to the ground using Class 3 wires for FG terminals which is exclusively used for PLC**. If the terminals not grounded correctly, abnormal operation or electric shock may be caused.
- **Don't let any foreign materials such as wiring waste inside the module while wiring,** which may cause fire, damage on the product or abnormal operation.
- **Make sure that pressed terminals get tighten following the specified torque. External connector type shall be pressed or soldered using proper equipments.**

Safety Instructions for test-operation and maintenance

⚠ Warning

- **Don't touch the terminal when powered**. Electric shock or abnormal operation may occur.
- **Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Don't let the battery recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

⚠ Caution

- **Do not make modifications or disassemble each module.** Fire, electric shock or abnormal operation may occur.
- **Prior to installing or disassembling the module, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Keep any wireless equipment such as walkie-talkie or cell phones at least 30cm away from PLC**. If not, abnormal operation may be caused.
- **When making a modification on programs or using run to modify functions under PLC operations, read and comprehend all contents in the manual fully.** Mismanagement will cause damages to products and accidents.
- **Avoid any physical impact to the battery and prevent it from dropping as well.** Damages to battery may cause leakage from its fluid. When battery was dropped or exposed under strong impact, never reuse the battery again. Moreover skilled workers are needed when exchanging batteries.

Safety Instructions for waste disposal

⚠ Caution

- **Product or battery waste shall be processed as industrial waste.** The waste may discharge toxic materials or explode itself.

Revision History

Version	Date	Remark	Page
V 1.0	’09. 9	First Edition	-

※ The number of User’s manual is indicated right part of the back cover.

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Thank you for purchasing PLC of LS Industrial System Co.,Ltd.
Before use, make sure to carefully read and understand the User's Manual about the functions, performances, installation and programming of the product you purchased in order for correct use and importantly, let the end user and maintenance administrator to be provided with the User's Manual.

The User's Manual describes the product. If necessary, you may refer to the following description and order accordingly. In addition, you may connect our website (http://eng.lsis.biz/) and download the information as a PDF file.

Relevant User's Manuals

Title	Description
XG5000 User's Manual (for XGK, XGB)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGK, XGB CPU
XG5000 User's Manual (for XGI, XGR)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGI, XGR CPU
XGK/XGB Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGK, XGB CPU.
XGI/XGR/XEC Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGI, XGR,XEC CPU.
XGK CPU User's Manual (XGK-CPUA/CPUE/CPUH/CPUS/CPUU)	XGK-CPUA/CPUE/CPUH/CPUS/CPUU user manual describing about XGK CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGI CPU User's Manual (XGI-CPUU/CPUH/CPUS)	XGI-CPUU/CPUH/CPUS user manual describing about XGI CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGR redundant series User's Manual	XGR- CPUH/F, CPUH/T user manual describing about XGR CPU module, power module, extension drive, base, IO module, specification of extension cable and system configuration, EMC standard

Current XGF-AH6A manual is written based on the following version.

Related OS version list

Product name	OS version
XGK-CPUH, CPUS, CPUA, CPUE, CPUU	V3.0
XGI-CPUU, CPUH, CPUS	V2.1
XGR-CPUH/F, CPUH/T	V1.3
XG5000(XG-PD)	V3.1

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Chapter 1 Overview

This manual describes the specifications, handling, and programming of the XGF-AH6A, analog input/output module, which is used in combination with the CPU module of the XGT PLC series. This module is for converting the analog signals (voltage or current input) of external device into digital values saved in PLC, or inversely, for converting the digital saved in PLC into the analog voltage or current output.

1.1 Characteristics

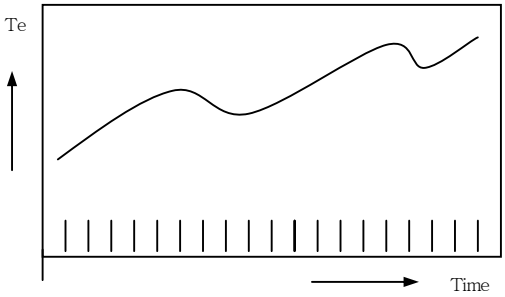
1.1.1 Input Characteristics

(1) No. of Channels: 4 channel input (no insulation between channels)
(2) Input Terminal: select voltage/current input by wiring method of terminal block
(3) Conversion Rate: 500 ㎲/channel
(4) Resolution: 1/8000
(5) Input Type: 4~20mA , 0~5V, 1~5V, 0~10V, -10~10V
(6) Data Scale: 0~8000, -4000~4000, 0~10000 and precise value per input range
(7) Averaging Method: time, count, and weighted average

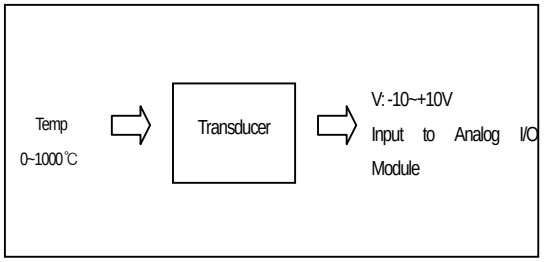
1.1.2 Output Characteristics

(1) No. of Channels: 2 channel output (no insulation between channels)
(2) Output Terminal: separated voltage/current output terminals
(3) Conversion Rate: 500 ㎲/channel
(4) Resolution: 1/8000
(5) Output Type: 4~20mA , 0~5V, 1~5V, 0~10V, -10~10V
(6) Data Scale: 0~8000, -4000~4000, 0~10000 and precise value per input range
(7) Abnormal status output function: previous, minimum, medium, and maximum values

1.2 Glossary



[Fig.1.1] Analog quantity

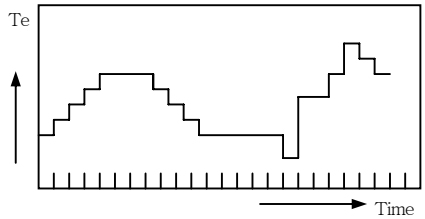


[Fig.1.2] An example of the transducer

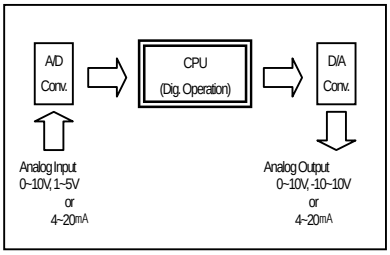
1.2.1 Analog Quantity - A

Analog quantity refers to the values which expresses continuous physical properties. As analog values are continuous, there is always a median value. General physical properties such as voltage, current, velocity, pressure and flux correspond to analog quantity. For example, the temperature changes continuously over time as shown in Fig. 1.1. Because temperature cannot be inputted directly into the analog I/O module, it needs to be relayed by a transducer that converts input signals of analog properties into electrical signals.

1.2.2 Digital Quantity - D



The data consisting of discrete integers such as 0, 1, 2, 3 are referred to as digital quantity (Fig. 1.3). The digital means the electronic method of creating, storing and processing the data in only 0 and 1. The data transmitted or stored by digital technology is expressed in a string of 0 and 1. For example, the on and off signals can be expressed in 0 and 1 digital values respectively, and the BCD or binary values are also digital values.

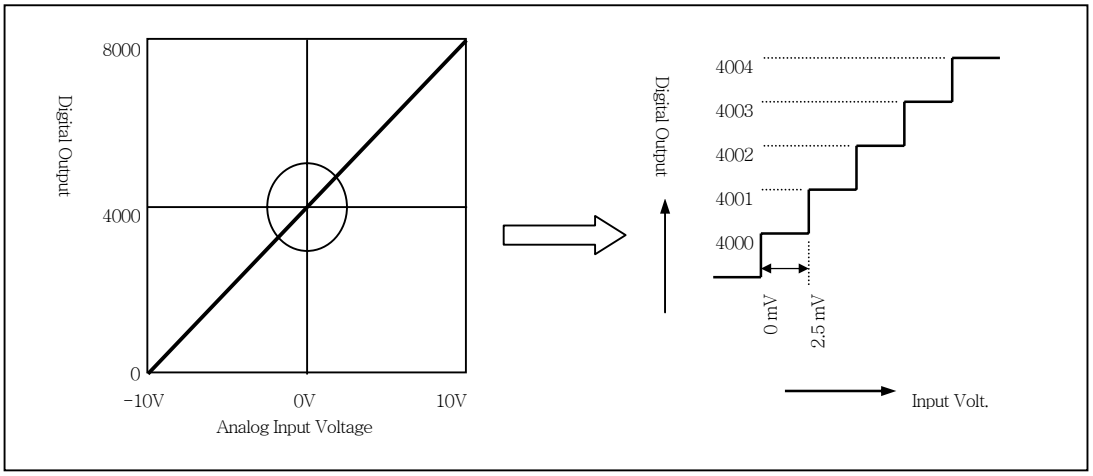


[Fig. 1.4] Process at PLC

Analog values cannot be directly inputted in the PLC CPU for an operation. That is why the analog values are converted into digital values when they are inputted into the PLC CPU as shown in Fig. 1.4. This is carried out by the analog input module. In addition, for the analog values to be outputted to the outside, the PLC CPU digital values should be converted into analog values. This function is conducted by the analog output module. The analog I/O module can perform the functions of both input and output modules.

1.2.3. The Characteristics of Analog Input

(1) Voltage Input

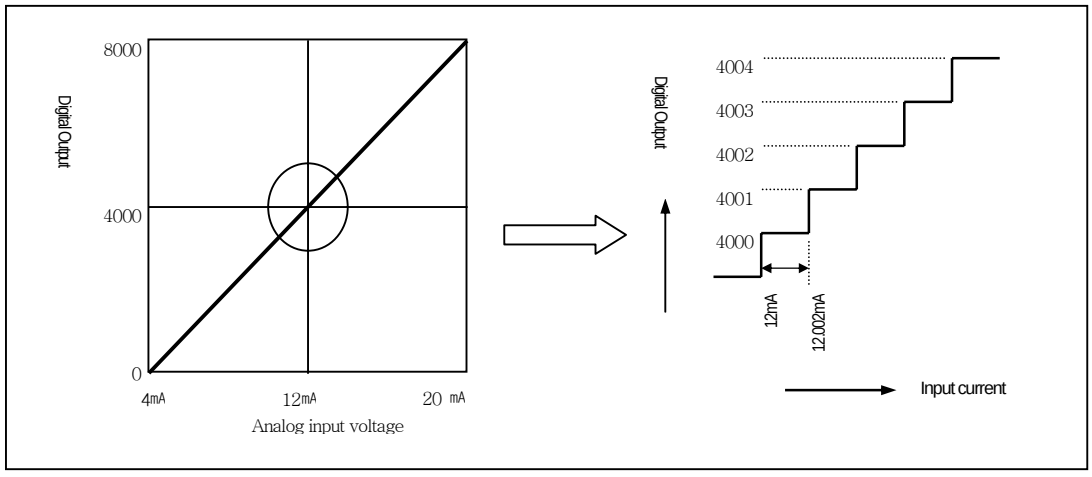


[Fig. 1.5] Characteristics of analog input (voltage input)

The analog input channel converts the analog electric signals that are inputted from an external device into digital values, which makes operations possible in the PLC CPU.

When -10 ~ 10 V is used as the analog input range in the analog I/O module, -10V analog input is outputted as digital value 0, and 10V analog input is outputted as 8000. Therefore, in this case, analog input 2.5mV corresponds to digital value 1 (Fig. 1.5).

(2) Current input

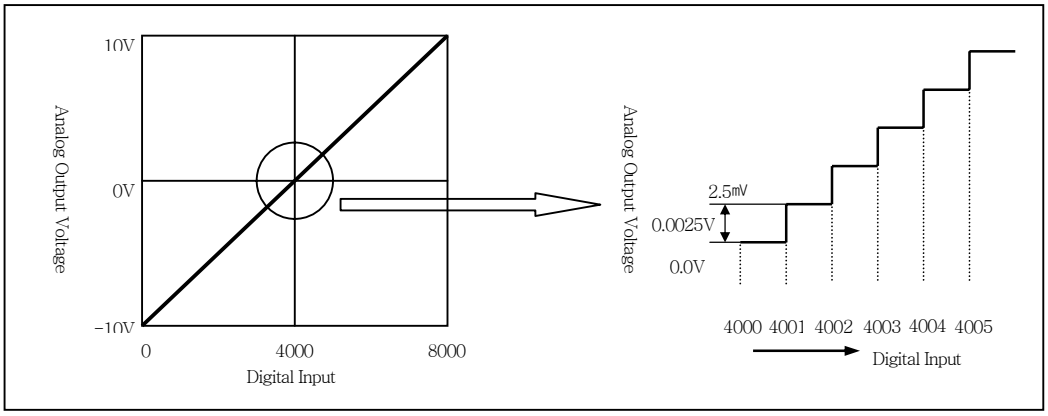


[Fig.1.6] Analog input characteristics (current input)

If 4-20mA is used as the analog input range, the analog input value of 4mA is outputted as digital value 0, and the analog input value of 20mA is outputted as the digital value of 8000. In this case, analog input 2 μA corresponds to digital value 1 (Fig. 1.6).

1.2.4. Analog Output Characteristics

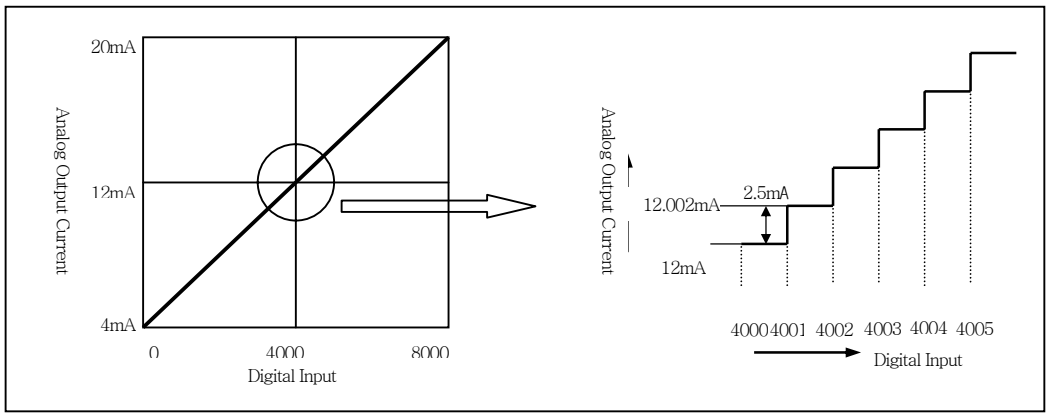
(1) Voltage Output



[Fig. 1.7] Analog output characteristics (voltage input)

The analog output channel creates the analog output in accordance with the digital input value. When the analog output range is set up to be between -10 ~ 10V, a digital input of 0 creates -10V analog output and digital input of 8000 creates 10V analog output. Therefore, in this case digital input value of 1 corresponds to 2.5mV analog output [Fig. 1.7]

(2) Current Output



[Fig. 1.8] Analog output characteristics (current)

When the analog output range is set up to be between 4 ~ 20mA, a digital input of 0 creates 4mA analog output and digital input of 8000 creates 20mA analog output. Therefore, in this case digital input value of 1 corresponds to 2㎂ analog output [Fig. 1.8].

Chapter 2 Specifications

2.1 General Specifications

Table 2.1 shows the general specifications of XGT series.

[Table 2.1] General specifications

<table>
<tr><th>No.</th><th>Item</th><th colspan="5">Specifications</th><th>Related standard</th></tr>
<tr><td>1</td><td>Operating temperature</td><td colspan="5">0 ~ 55 ℃</td><td></td></tr>
<tr><td>2</td><td>Storage temperature</td><td colspan="5">–25 ~ +70 ℃</td><td></td></tr>
<tr><td>3</td><td>Operating humidity</td><td colspan="5">5 ~ 95%RH, no condensation</td><td></td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="5">5 ~ 95%RH, no condensation</td><td></td></tr>
<tr><td rowspan="9">5</td><td rowspan="9">Anti-vibration</td><td colspan="4">When there is intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td>Number of times</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10 ≤ f < 57Hz</td><td colspan="2">–</td><td>0.075mm</td><td rowspan="5">10 times each in directions of X, Y, Z</td></tr>
<tr><td>57 ≤ f ≤ 150Hz</td><td colspan="2">9.8m/s^2(1G)</td><td>–</td></tr>
<tr><td colspan="4">When there is incessant vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td></tr>
<tr><td>10 ≤ f < 57Hz</td><td colspan="2">–</td><td>0.035mm</td></tr>
<tr><td>57 ≤ f ≤ 150Hz</td><td colspan="2">4.9m/s^2(0.5G)</td><td>–</td></tr>
<tr><td>6</td><td>Anti-shock</td><td colspan="5">• Maximum shock acceleration: 147 m/s^2(15G)
(Apply time : 11ms
(Pulse wave pattern : half sine pulse (3 times each in directions X, Y and Z)</td><td>IEC61131-2
(IEC60068-2-27)</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Anti-noise</td><td>Rectangular impulse noise</td><td colspan="4">±1,500 V</td><td>In-house testing standard of LS</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">Voltage : ±4 kV (contact discharge)</td><td>IEC61131-2
(IEC61000-4-2)</td></tr>
<tr><td>Radiation electronic noise</td><td colspan="4">27 ~ 500 MHz, 10V/m</td><td>IEC61131-2
(IEC61000-4-3)</td></tr>
<tr><td rowspan="2">Past transient / bust noise</td><td>Classification</td><td>Power module</td><td colspan="2">Digital/analog input/output communication interface</td><td rowspan="2">IEC61131-2
(IEC61000-4-4)</td></tr>
<tr><td>Voltage</td><td>2kV</td><td colspan="2">1kV</td></tr>
<tr><td>8</td><td>Environment</td><td colspan="5">No corrosive gas or dust</td><td></td></tr>
<tr><td>9</td><td>Altitude</td><td colspan="5">Below 2,000m</td><td></td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="5">Below 2</td><td></td></tr>
<tr><td>11</td><td>Cooling</td><td colspan="5">Natural air cooling</td><td></td></tr>
</table>

Note

(1) IEC (International Electrotechnical Commission): An international private group, aiming at promoting international cooperation for standardization in electrical and electronic technology areas, publishes international standards and operates the related conformity assessment systems.

(2) Pollution degree: an indicator that shows the pollution degree of the environment that determines the insulation of a device. Pollution degree 2 is when there is only non-conductive contamination, and there is short conductivity when there is condensation.

2.2 Performance Specifications

Table 2.2 and 2.3 show the performance specifications of the analog I/O module.

[Table 2.2] Input performance specifications

<table>
<tr><th rowspan="2">Classification</th><th colspan="5">Specifications</th></tr>
<tr><th colspan="3">Voltage</th><th colspan="2">Current</th></tr>
<tr><td>No. of input channels</td><td colspan="5">4 channels</td></tr>
<tr><td rowspan="2">Analog input range</td><td colspan="3">DC 1 ~ 5V
DC 0 ~ 5V
DC 0 ~ 10V
DC -10 ~ 10V
Input resistance
: 1MΩ min or above</td><td colspan="2">DC 4 ~ 20㎃ Input resistance
: 250Ω</td></tr>
<tr><td colspan="5">Use the V+ and COM terminals of the channel for voltage input.
Connect the V+ and I+ terminals and use I+ and COM terminals for current input.</td></tr>
<tr><td>Digital Data</td><td colspan="5">
<table>
<tr><td>Voltage Input</td><td>1 ~ 5V</td><td>0 ~ 5V</td><td>0 ~ 10V</td><td>-10 ~ 10V</td></tr>
<tr><td>Unsigned Value</td><td colspan="4">0 ~ 8000</td></tr>
<tr><td>Signed Value</td><td colspan="4">-4000 ~ 4000</td></tr>
<tr><td>Precise Value</td><td>1000 ~ 5000</td><td>0 ~ 5000</td><td>0 ~ 10000</td><td>-10000 ~ 10000</td></tr>
<tr><td>Percentile Value</td><td colspan="4">0 ~ 10000</td></tr>
</table>
<table>
<tr><td>Current Input</td><td>4 ~ 20mA</td></tr>
<tr><td>Unsigned Value</td><td>0 ~ 8000</td></tr>
<tr><td>Signed Value</td><td>-4000 ~ 4000</td></tr>
<tr><td>Precise Value</td><td>4000 ~ 20000</td></tr>
<tr><td>Percentile Value</td><td>0 ~ 10000</td></tr>
</table>
The I/O parameters or user software program of the XG5000 allows selection of the input type and range of each channel.
</td></tr>
<tr><td>Input Resolution</td><td colspan="5">1/8000 (for each input range)
<table>
<tr><td>1~5 V</td><td>0.5 ㎷</td><td rowspan="4">4~20 ㎃</td><td rowspan="4">2.0 ㎂</td></tr>
<tr><td>0~5 V</td><td>0.625 ㎷</td></tr>
<tr><td>0~10 V</td><td>1.25 ㎷</td></tr>
<tr><td>±10 V</td><td>2.5 ㎷</td></tr>
</table></td></tr>
<tr><td>Input Precision</td><td colspan="5">±0.2% max. (ambient temperature at 25 ℃ ±5 ℃)
±0.3% max. (ambient temperature within 0 ℃ ~ 55 ℃)</td></tr>
<tr><td>Conversion Rate</td><td colspan="5">500㎲/channel</td></tr>
<tr><td>Absolute Max. Input</td><td colspan="3">±15 V</td><td colspan="2">±30 ㎃</td></tr>
<tr><td>Insulation</td><td colspan="5">No insulation between analog I/O and channels.
i-Coupler insulation between I/O terminals and PLC power supply</td></tr>
<tr><td>Connection Terminal</td><td colspan="5">18 points terminal block (12 inputs, 6 output points)</td></tr>
<tr><td>Input and output occupancy point</td><td colspan="5">Fixed type: 64, adjustable type: 16 points</td></tr>
<tr><td>Current Consumption</td><td colspan="5">770 mA</td></tr>
<tr><td>Weight</td><td colspan="5">140 g</td></tr>
</table>

[Table 2.3] Output performance specifications

<table>
<tr><th rowspan="2">Classification</th><th colspan="6">Specifications</th></tr>
<tr><th colspan="3">Voltage</th><th colspan="3">Current</th></tr>
<tr><td>No. of output channels</td><td colspan="6">2 channels</td></tr>
<tr><td rowspan="2">Analog output Range</td><td colspan="3">DC 1 ~ 5V
DC 0 ~ 5V
DC 0 ~ 10V
DC -10 ~ 10V
Load resistance : 1kΩ min.</td><td colspan="3">DC 4 ~ 20mA Load resistance : 600Ω max.</td></tr>
<tr><td colspan="6">Use the V+ and COM terminals of the channel for voltage output.
Use the I+ and COM terminals for current output.</td></tr>
<tr><td>Digital Data</td><td colspan="6">
<table>
<tr><td>Voltage Output</td><td>1 ~ 5V</td><td>0 ~ 5V</td><td>0 ~ 10V</td><td>-10 ~ 10V</td></tr>
<tr><td>Unsigned Value</td><td colspan="4">0 ~ 8000</td></tr>
<tr><td>Signed Value</td><td colspan="4">-4000 ~ 4000</td></tr>
<tr><td>Precise Value</td><td>1000 ~ 5000</td><td>0 ~ 5000</td><td>0 ~ 10000</td><td>-10000 ~ 10000</td></tr>
<tr><td>Percentile Value</td><td colspan="4">0 ~ 10000</td></tr>
</table>
<table>
<tr><td>Current Output</td><td>4 ~ 20mA</td></tr>
<tr><td>Unsigned Value</td><td>0 ~ 8000</td></tr>
<tr><td>Signed Value</td><td>-4000 ~ 4000</td></tr>
<tr><td>Precise Value</td><td>4000 ~ 20000</td></tr>
<tr><td>Percentile Value</td><td>0 ~ 10000</td></tr>
</table>
The I/O parameters or user software program for the XG5000 allows selection of the output type and range of each channel.
</td></tr>
<tr><td>Output Resolution</td><td colspan="6">1/8000 (for each output range)
<table>
<tr><td>1~5 V</td><td>0.5 mV</td><td rowspan="4">4~20 mA</td><td rowspan="4">2.0 μA</td></tr>
<tr><td>0~5 V</td><td>0.625 mV</td></tr>
<tr><td>0~10 V</td><td>1.25 mV</td></tr>
<tr><td>±10 V</td><td>2.5 mV</td></tr>
</table></td></tr>
<tr><td>Output Precision</td><td colspan="6">±0.2% max. (ambient temperature at 25 ℃ ±5 ℃)
±0.3% max. (ambient temperature within 0 ℃ ~ 55 ℃)</td></tr>
<tr><td>Conversion Rate</td><td colspan="6">500μs/channel</td></tr>
<tr><td>Absolute Max. Output</td><td colspan="3">±15 V</td><td colspan="3">24 mA</td></tr>
<tr><td>Insulation</td><td colspan="6">No insulation between analog I/O and channels.
i-Coupler insulation between I/O terminals and PLC power supply</td></tr>
<tr><td>Access Terminal</td><td colspan="6">18 points terminal block (12 inputs, 6 output points)</td></tr>
<tr><td>Input and output occupancy point</td><td colspan="6">Fixed type: 64, adjustable type: 16 points</td></tr>
</table>

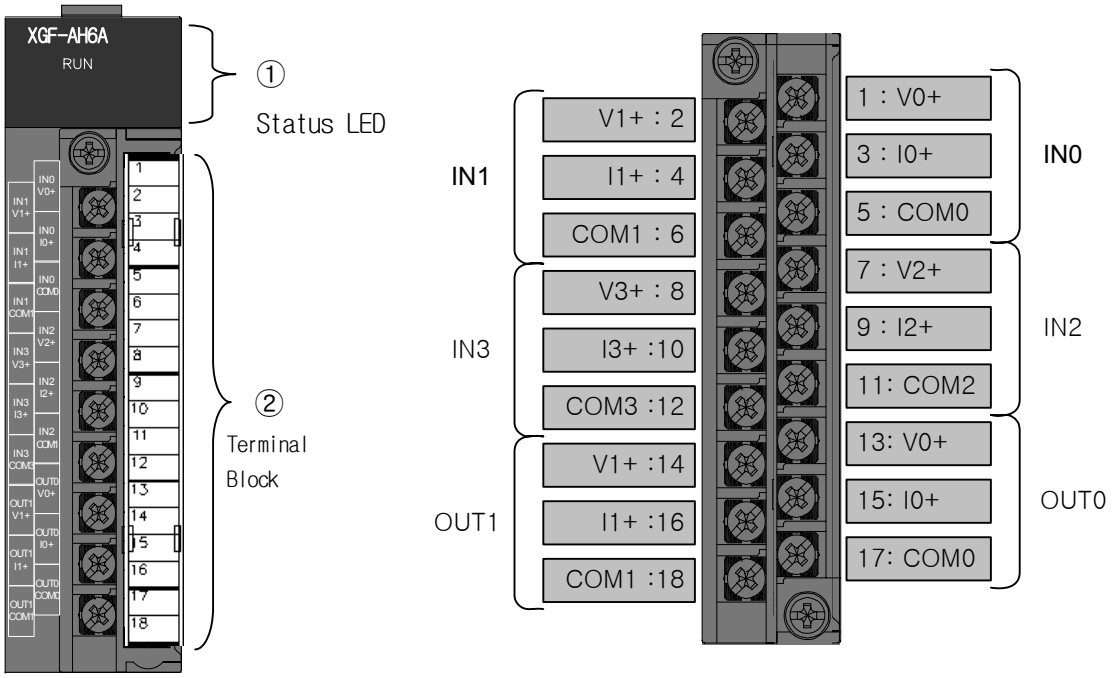
Note

(1) The offset/gain values about the analog input and output ranges are factory set up, and user cannot change these settings.
(2) Offset value: the analog input value of which the digital output value is 0 when the digital output type is set as an unsigned value
(3) Gain value: the analog input value of which the digital output value is 8000 when the digital output type is set as an unsigned value.
(4) The XGR system can be used at the extension bases, not the basic base.

2.3 Name of the Parts

This section is about the name of each part.

2.3.1 XGF-AH6A



No.	Name	Description	
①	Status Indicator LED	On	Normal operation
		Off	Incorrectly installed
		Blinking	Abnormal state
②	Terminal Block	1 : IN0 V0+	Channel 0 Voltage input
		2 : IN0 V1+	Channel 1 Voltage input
		3 : IN0 I0+	Channel 0 Current input, use in connection with IN0 V0
		4 : IN1 I1+	Channel 1 Current input, use in connection with IN1 V1
		5 : IN0 COM0	Channel 0 Voltage/Current input common ground
		6 : IN1 COM1	Channel 1 Voltage/Current input common ground
		7 : IN2 V2+	Channel 2 Voltage input
		8 : IN3 V3+	Channel 3 Voltage input
		9 : IN2 I2+	Channel 2 Current input, use in connection with IN2 V2
		10: IN3 I3+	Channel 3 Current input, use in connection with IN3 V3
		11: IN2 COM2	Channel 2 Voltage/Current common ground
		12: IN3 COM3	Channel 3 Voltage/Current common ground
		13: OUT0 V0+	Channel 0 Voltage output
		14: OUT1 V1+	Channel 1 Voltage output
		15: OUT0 I0+	Channel 0 Current output
		16: OUT1 I1+	Channel 1 Current output
		17: OUT0 COM0	Channel 0 Voltage/Current output common ground
		18: OUT1 COM1	Channel 1 Voltage/Current output common ground

2.4 Characteristics of Input/Output Conversion

2.4.1 Digital Data Types

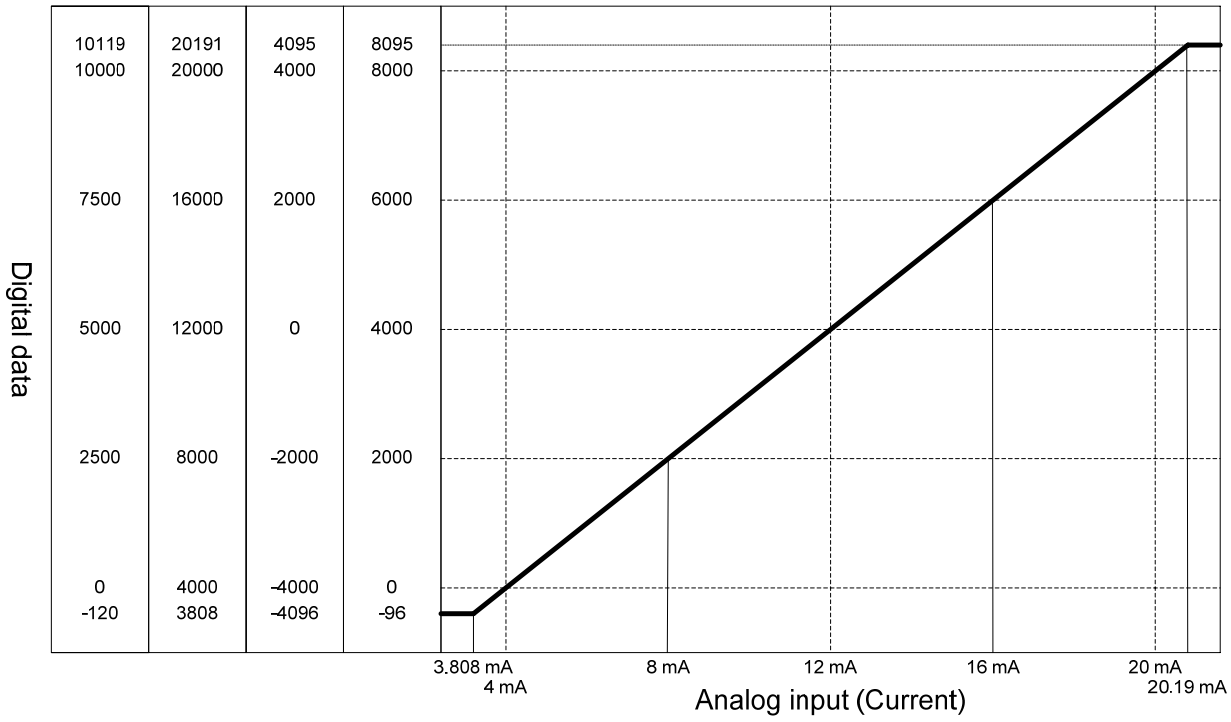
Digital data types are defined as follows;

(1) Unsigned Value
(2) Signed Value
(3) Precise Value
(4) Percentile Value

2.4.2 Characteristics of the Input Data Conversion

The graph below shows the data converion characteristics per input range.

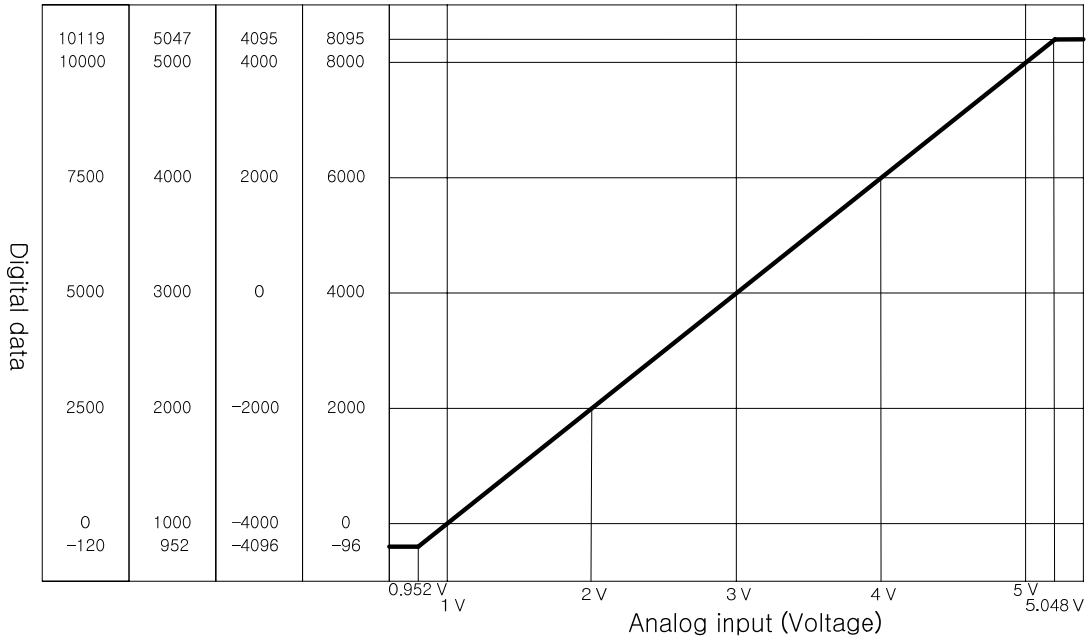
(1) Input range: DC 4 ~ 20 mA



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 2 μA

Analog Input	Digital Data			
	Unsigned Value (-96 ~ 8095)	Signed Value (-4096 ~ 4095)	Precise Value (3808 ~ 20191)	Percentile Value (-120 ~ 10119)
3.808mA	-96	-4096	3808	-120
4 mA	0	-4000	4000	0
8 mA	2000	-2000	8000	2500
12 mA	4000	0	12000	5000
16 mA	6000	2000	16000	7500
20 mA	8000	4000	20000	10000
20.19mA	8095	4095	20191	10119

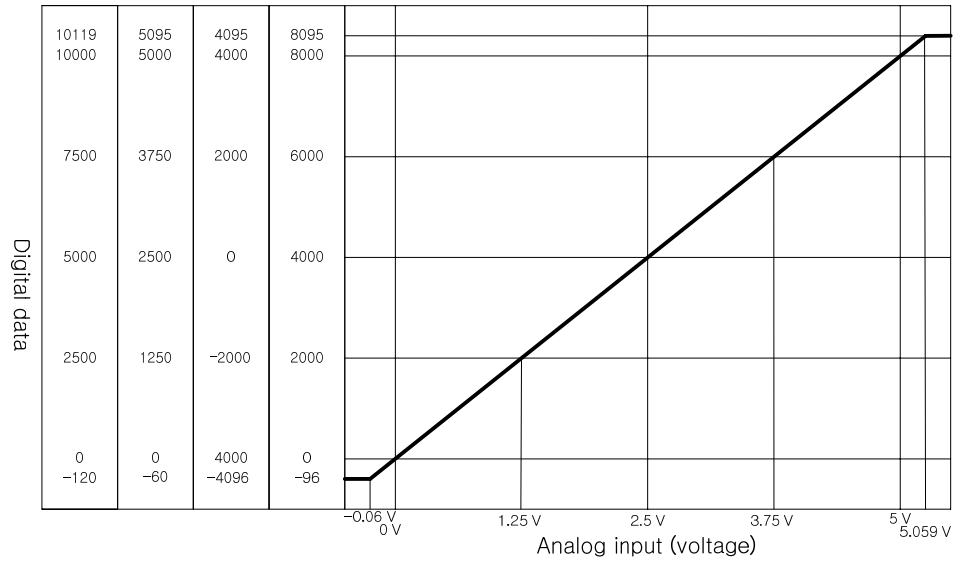
(2) Input range: DC 1 ~ 5 V



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 0.5 mV

Analog Input	Digital Data			
	Unsigned Value (-96 ~ 8095)	Signed Value (-4096 ~ 4095)	Precise Value (952 ~ 5047)	Percentile Value (-120 ~ 10119)
0.952 V	-96	-4096	952	-120
1 V	0	-4000	1000	0
2 V	2000	-2000	2000	2500
3 V	4000	0	3000	5000
4 V	6000	2000	4000	7500
5 V	8000	4000	5000	10000
5.048 V	8095	4095	5047	10119

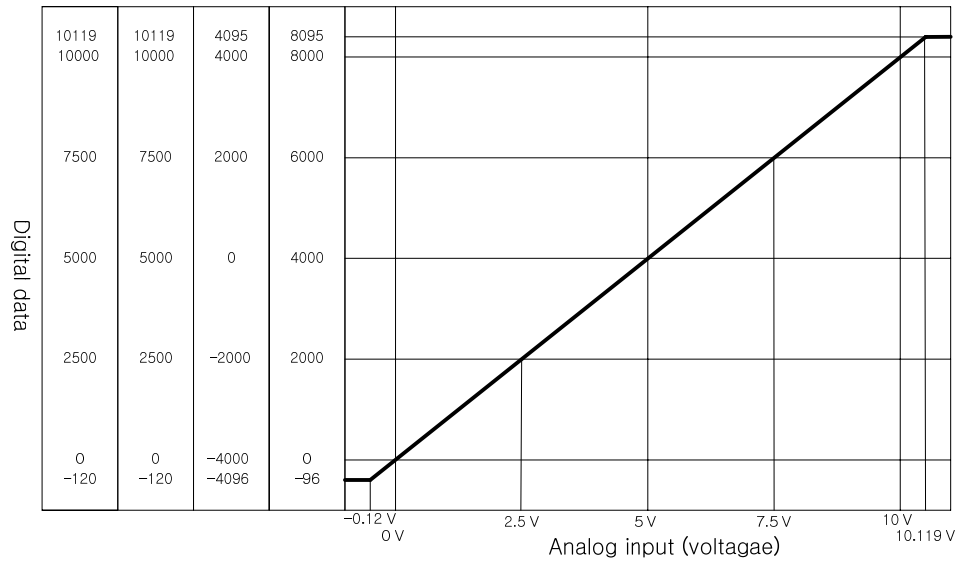
(3) Input range; DC 0 ~ 5 V



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 0.625 mV

Analog Input	Digital Data			
	Unsigned Value (-96 ~ 8095)	Signed Value (-4096 ~ 4095)	Precise Value (-60 ~ 5059)	Percentile Value (-120 ~ 10119)
-0.06 V	-96	-4096	-60	-120
0 V	0	-4000	0	0
1.25 V	2000	-2000	1250	2500
2.5 V	4000	0	2500	5000
3.75 V	6000	2000	3750	7500
5 V	8000	4000	5000	10000
5.059 V	8095	4095	5059	10119

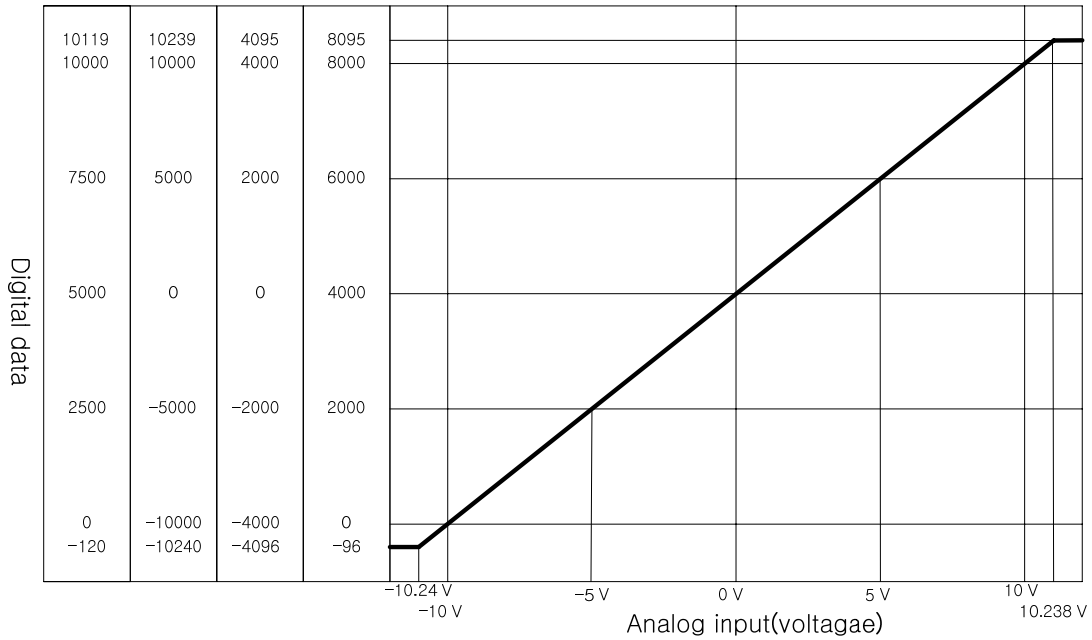
(4) Input range: DC 0 ~ 10 V



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 1.25 mV

Analog Input	Digital Data			
	Unsigned Value (-96 ~ 8095)	Signed Value (-4096 ~ 4095)	Precise Value (-120 ~ 10119)	Percentile Value (-120 ~ 10119)
-0.12 V	-96	-4096	-120	-120
0 V	0	-4000	0	0
2.5 V	2000	-2000	2500	2500
5 V	4000	0	5000	5000
7.5 V	6000	2000	7500	7500
10 V	8000	4000	10000	10000
10.119 V	8095	4095	10119	10119

(5) Input range: DC -10 ~ 10 V



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 2.5 mV

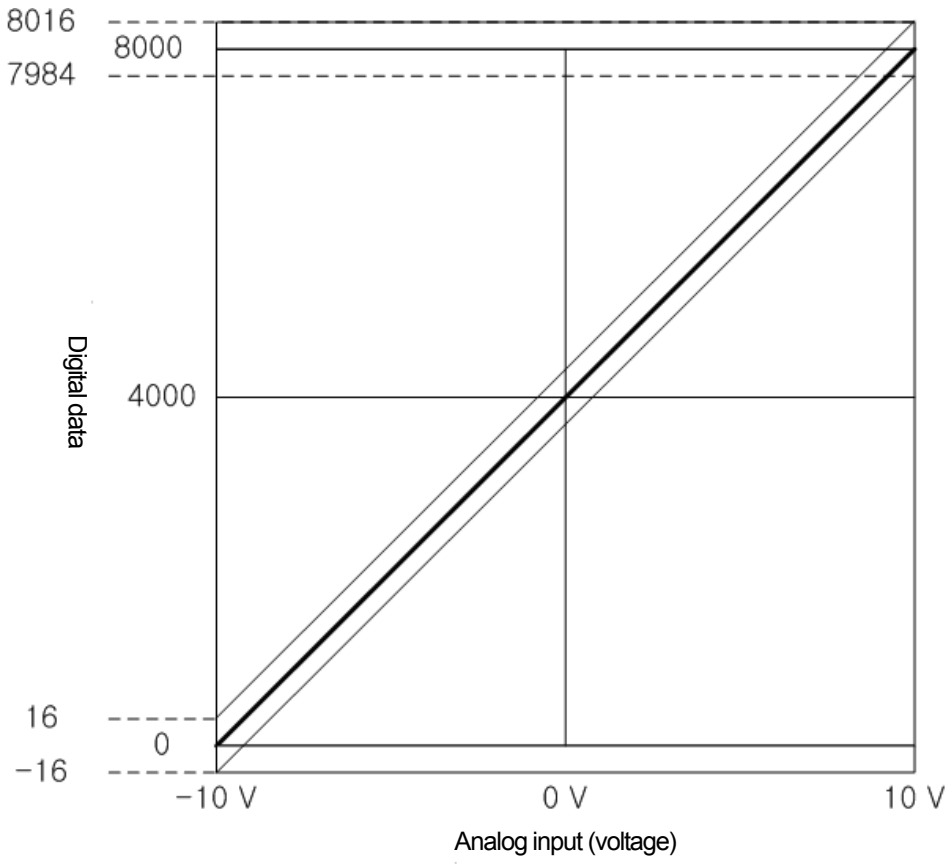
Analog Input	Digital Data			
	Unsigned Value (-96 ~ 8095)	Signed Value (-4096 ~ 4095)	Precise Value (-10240 ~ 10239)	Percentile Value (-120 ~ 10119)
-10.24 V	-96	-4096	-10240	-120
-10 V	0	-4000	-10000	0
-5 V	2000	-2000	-5000	2500
0 V	4000	0	0	5000
5 V	6000	2000	5000	7500
10 V	8000	4000	10000	10000
10.238 V	8095	4095	10239	10119

Note

1) The analog inputs out of the defined digital data range are rounded off at the maxi/min limit values. For example, if the digital data range is defined as Unsigned Value (–96 ~ 8095), the digital output value converted from the analog input which is less than -96 or larger than 8095 is limited to -96 or 8095, respectively.
2) Do not put the voltage and current beyond ±15 V and ±30 ㎃ respectively. Otherwise it may cause a failure due to over heating.

2.4.3 Input Precision

The precision for the digital output value does not change if the input range is changed. The figure below shows the range of precision at surrounding temperature of 25 ± 5℃ when the analog input range and digital output type are set at -10 ~ 10 V and Unsigned Value respectively. The precision is ±0.2% and ±0.3% when the surrounding temperature is 25 ± 5℃ and 0 ~ 55℃ respectively.



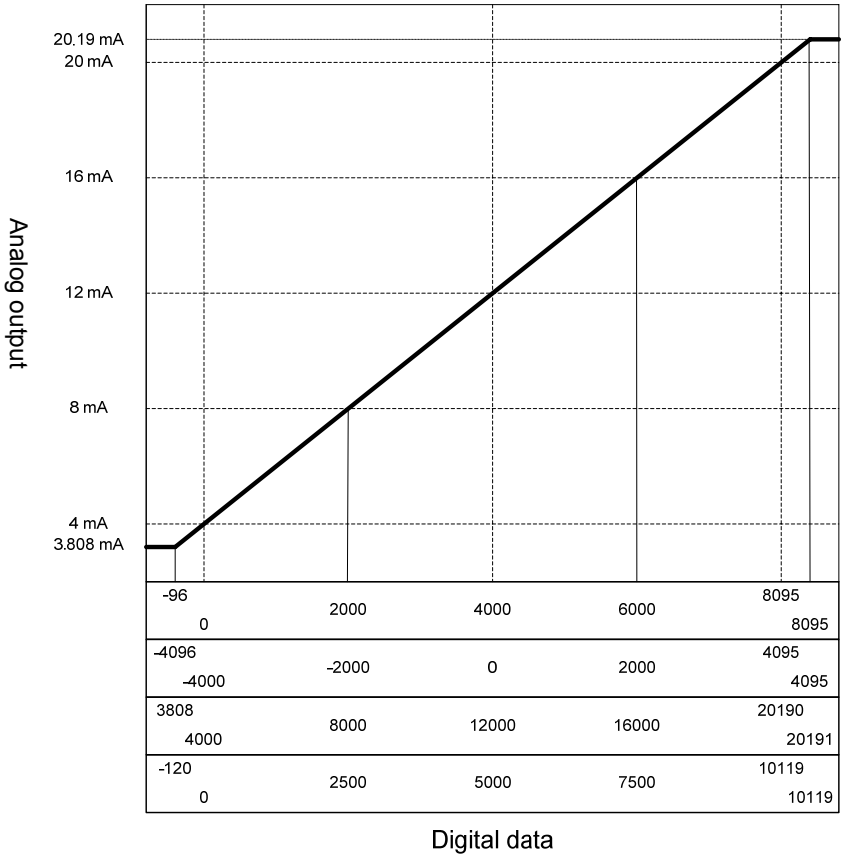
2.4.4 Output Conversion Characteristics

A digital data type is defined as one of the followings;

(1) Unsigned Value
(2) Signed Value
(3) Precise Value
(4) Percentile Value

2.4.5 Output Data Conversion Characteristics

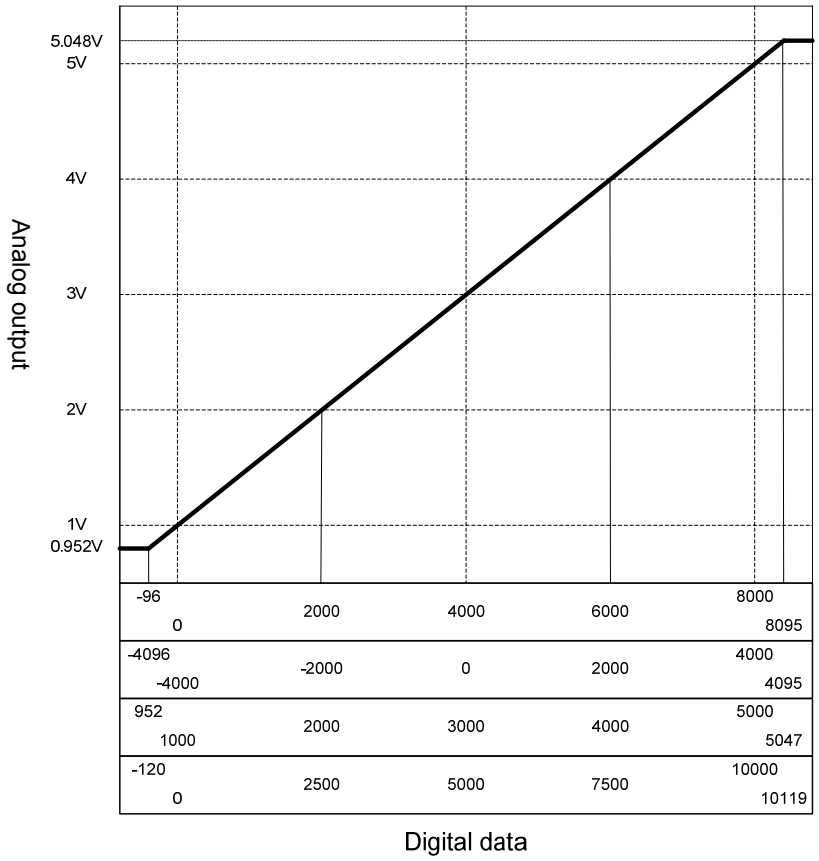
(1) Output range: DC 4 ~ 20 mA



(a) Analog output corresponding to digital data 1 (resolution 1/8000) = 2 μA

Digital Data	Analog Output (mA)						
	3.808	4	8	12	16	20	20.19
Unsigned Value (-96 ~ 8095)	-96	0	2000	4000	6000	8000	8095
Signed Value (-4096 ~ 4095)	-4096	-4000	-2000	0	2000	4000	4095
Precise Value (3808 ~ 20191)	3808	4000	8000	12000	16000	20000	20191
Percentile Value (-120 ~ 10119)	-120	0	2500	5000	7500	10000	10119

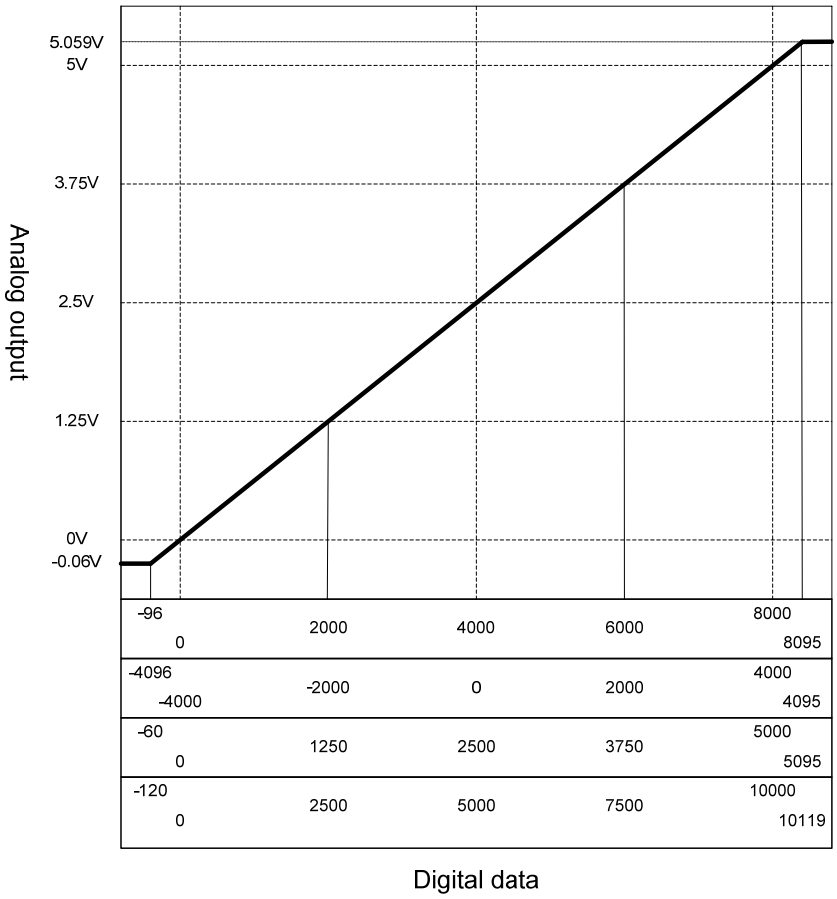
(2) Output range: DC 1 ~ 5 V



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 0.5 mV

Digital Data	Analog Output (V)						
	0.952	1	2	3	4	5	5.048
Unsigned Value (-96 ~ 8095)	-96	0	2000	4000	6000	8000	8095
Signed Value (-4096 ~ 4095)	-4096	-4000	-2000	0	2000	4000	4095
Precise Value (952 ~ 5047)	952	1000	2000	3000	4000	5000	5047
Percentile Value (-120 ~ 10119)	-120	0	2500	5000	7500	10000	10119

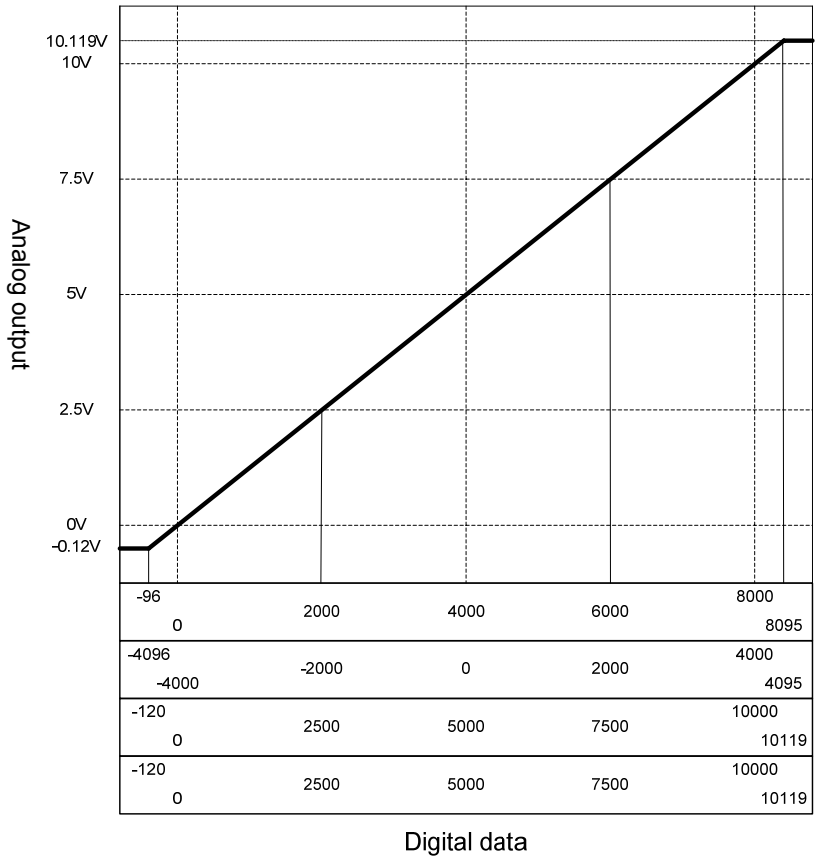
(3) Output range: DC 0 ~ 5 V



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 0.625 mV

Digital Data	Analog Output (V)						
	-0.06	0	1.25	2.5	3.75	5	5.059
Unsigned Value (-96 ~ 8095)	-96	0	2000	4000	6000	8000	8095
Signed Value (-4096 ~ 4095)	-4096	-4000	-2000	0	2000	4000	4095
Precise Value (-60 ~ 5059)	-60	0	1250	2500	3750	5000	5059
Percentile Value (-120 ~ 10119)	-120	0	2500	5000	7500	10000	10119

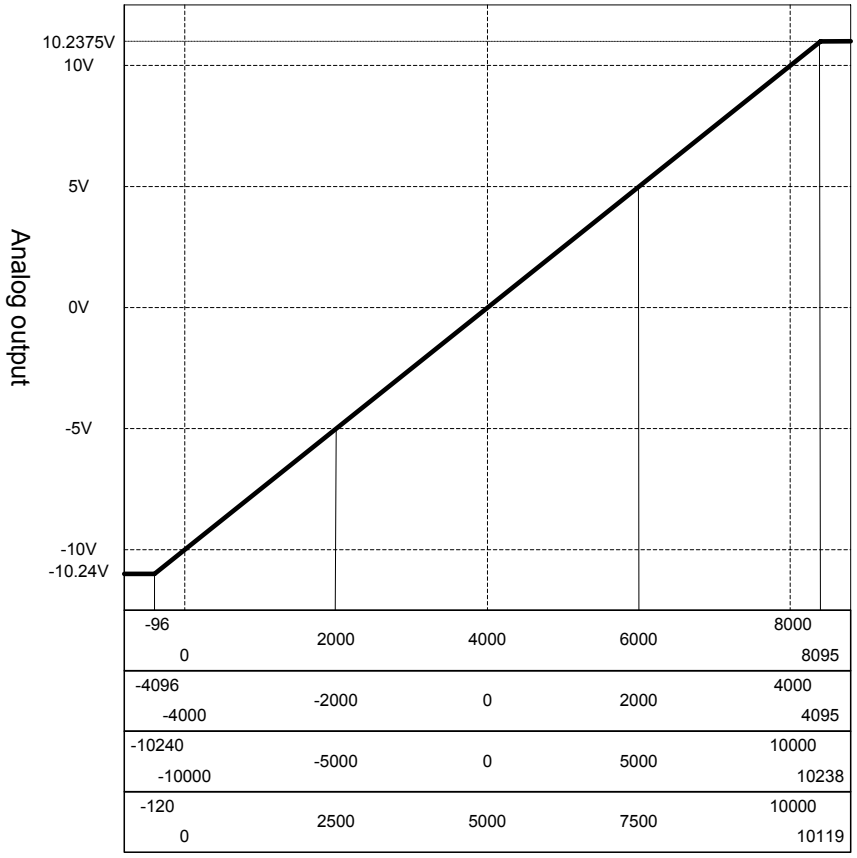
(4) Output range: DC 0 ~ 10 V



(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 1.25 mV

Digital Data	Analog Output (V)						
	-0.12	0	2.5	5	7.5	10	10.119
Unsigned Value (-96 ~ 8095)	-96	0	2000	4000	6000	8000	8095
Signed Value (-4096 ~ 4095)	-4096	-4000	-2000	0	2000	4000	4095
Precise Value (-120 ~ 10119)	-120	0	2500	5000	7500	10000	10119
Percentile Value (-120 ~ 10119)	-120	0	2500	5000	7500	10000	10119

(5) Output range: DC -10 ~ 10 V

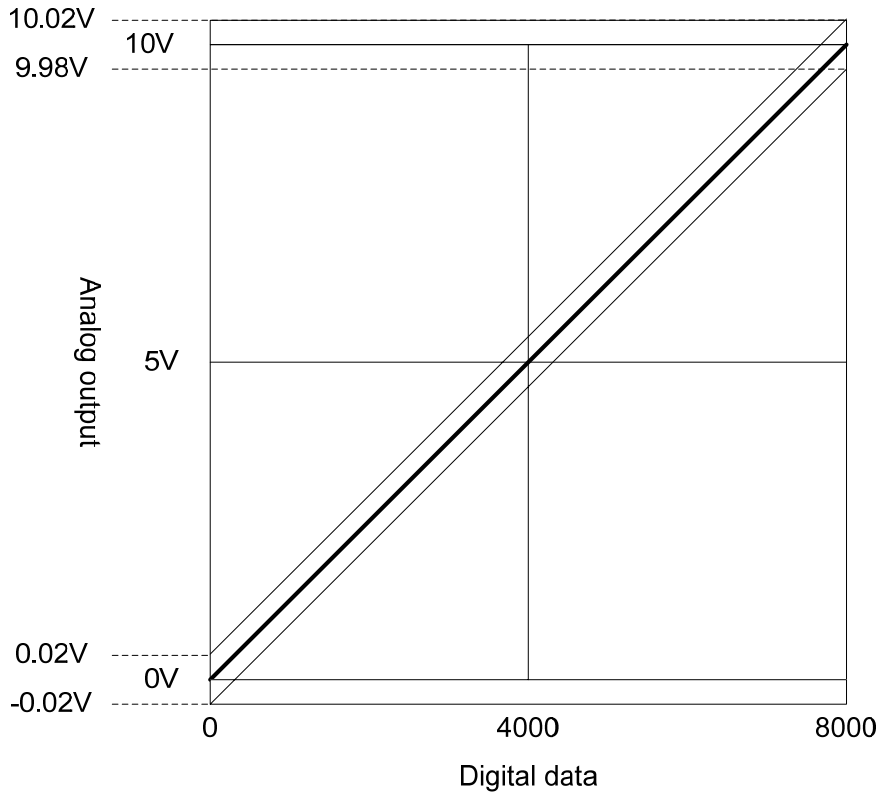


(a) Analog input corresponding to digital data 1 (resolution 1/8000) = 2.5 mV

Digital Data	Analog Output (mA)						
	-10.24	-10	-5	0	5	10	10.2375
Unsigned Value (-96 ~ 8095)	-96	0	2000	4000	6000	8000	8095
Signed Value (-4096 ~ 4095)	-4096	-4000	-2000	0	2000	4000	4095
Precise Value (-10240 ~ 10238)	-10240	-10000	-5000	0	5000	10000	10238
Percentile Value (-120 ~ 10119)	-120	0	2500	5000	7500	10000	10119

2.4.6 Output Precision

The precision for the digital output value does not change if the output range is changed. The figure below shows the range of precision at surrounding temperature of 25 ± 5℃ when the analog output range and digital output type are set at 0 ~ 10 V and Unsigned Value respectively. The precision is ±0.2% and ±0.3% when the surrounding temperature is 25 ± 5℃ and 0 ~ 55℃ respectively.



2.5 Functions of the Analog I/O Module

2.5.1 Specifications of the Input Functions

The input functions of the analog I/O module are set forth described.

[Table 2.4] List of the Input Functions

Functions	Description
Operating channel setting	(1) Specifies the start/stop of the channel performing the analog input conversion. (2) Setting unused channels in Stop can save analog input time. That doesn't affect analog output time.
Set input voltage/current ranges	(1) Specifies the analog input range to be used. (2) Provide 1 current input range (a) 4 ~ 20 mA (3) Provide 4 voltage input ranges; (a) 1 ~ 5 V (b) 0 ~ 5 V (c) 0 ~ 10 V (d) -10 ~ 10 V
Set output data type	(1) Specifies digital output type. (2) Provide 4 output data types; (a) 0 ~ 8000 (b) -4000 ~ 4000 (c) Precise Value per input (d) 0 ~ 10000
Set averaging process	(1) Sampling process When no A/D conversion method was defined, output data is created by each sampling without conducting averaging process. (2) Averaging process (a) Time average Outputs the A/D converted value averaged over the specified time. (b) Count average Outputs the A/D converted value averaged over the specified number. (c) Weighted average Delays abrupt change in the entered A/D converted value.
Input open wire detection	(1) User program can detect the open circuit of the 4 ~ 20 mA and 1 ~ 5 V range analog input.

2.5.2 Averaging Function

The data entered and converted are averaged by time, count or weight and outputted. This function is to convert abnormal analog input signals such as a noise into the values similar to the normal analog input signals.
The input channel of the analog I/O module supports time, count, and weighted averaging processes.

(1) Time average

Outputs the result of the sampling data averaged over the specified time.

(a) Setting range: 4~16000ms
(b) Frequency: setting time divided by the conversion cycle period

1) Example
If the setting time is 26ms and 2 channels are used;
Conversion period: since 2 channel operation, each channel is driven at 1ms intervals (500㎲ * 2 Channels)

Number of process = 26ms / 1ms

That is, the channel collects 26 sampling data per 26ms according to the time average setting, calculates the average value to output.
In the internal calculation, the time average process is conducted after converting into count averaging method, as shown in the above example, and the result is cut off at decimal point.

(c) If the setting value is less than 4 or larger than 16000, the lower and upper limit will be 4 or 16000, respectively.
(d) If the setting value exceeds the setting range, error state will be generated and the RUN LED will blink at 1 second intervals. To reset the error, correct the setting value according to the allowable range, and use the error clear request flag (UXY.07.0) or switch the PLC from STOP to RUN.
(e) In case of error in time average setting, the initial value will be saved as the initial value.
(f) Since each input signal is converted at 2ms intervals in whole channel operation, at least 4ms average needs to be maintained to enable averaging process.

(2) Count average

Outputs the result of the sampling data averaged over the specified number.

(a) Setting range: 2 ~ 64000 (times)
(b) Period for averaging by number: the time calculated by set up number multiplied with the conversion period
(c) If the setting value is less than 2 or larger than 64000, the lower and upper limit will be 2 or 64000, respectively. .
(d) If the setting value exceeds the setting range, error state will be generated and the RUN LED will blink at 1 second intervals. To reset the error, correct the setting value according to the allowable range, and use the error clear request flag (UXY.07.0) or switch the PLC from STOP to RUN.

(3) Weighted average

The weighted averaging function enables smoother process of input data by filtering (delaying) the input sampling data.
(a) Setting range: 1 ~ 99(%).
(b) Calculation method: sum of the set-up percentage of the previous sampling data and the remaining percentage of the present sampling data.

Present data = (Previous data * Set-up value %) + (Present data * (100-set up value)%)

Setting	Filter Output Value				Description
	-	1 Scan	2 Scan	3 Scan	
Unset	0	8000	8000	8000	No weighted averaging
1	0	7920	7999	7999	1% of the previous value is considered
50	0	4000	6000	7000	50 % of the previous value is considered
99	0	80	159	237	99 % of the previous value is considered

(c) If the setting value is 1 or less or 99 or more, the limit of the output value will be 1 or 99, respectively.

(d) If the setting value exceeds the setting range, error state will be generated and the RUN LED will blink at 1 second intervals. To reset the error, correct the setting value according to the allowable range, and use the error clear request flag (UXY.07.0) or switch the PLC from STOP to RUN.

2.5.3 Open Input Circuit Detection Function

(1) Allowable input range

The open wire in the input circuit can be detected when the input signal ranges are 4 ~ 20 mA or 1 ~ 5 V, at the criteria presented in the table below.

Input signal range	Voltage/current considered to be cased by open circuit
4 ~ 20 mA	0.8 mA or less
1 ~ 5 V	0.2 V or less

(2) Open circuit indication by channel

The open circuit detection signal of each input channel is stored in UXY. 07.
(X is the base number and Y is the slot number)

Bit	15 ~ 4	3	2	1	0
Initial Value	0	0	0	0	0
Allocation	-	CH3	CH2	CH1	CH0

Bit	Status
0	Normal
1	Open

(3) Operation

Each bit is set to 1 if open circuit is detected in the allocated channel, and returns to 0 when the circuit is restored. Each bit can be used for detecting open circuit in user program, like a condition of execution.

2.5.4 Specification of the Functions of the Output part

This section describes the output function of the analog I/O module.

[Table 2.5] Output function list

Function	Description
Operating channel setting	(1) Specifies the start/stop of the channel performing the analog output conversion. (2) Setting unused channels in Stop can save analog output time, without affecting analog input time.
Set output voltage/current ranges	(1) Specifies the analog output range to be used. (2) Provide 1 current output range (a) 4 ~ 20 mA (3) Provide 4 voltage output ranges (a) 1 ~ 5 V (b) 0 ~ 5 V (c) 0 ~ 10 V (d) -10 ~ 10 V
Set input data type	(1) Specifies digital data type. (2) Provide 4 data types; (a) 0 ~ 8000 (b) -4000 ~ 4000 (c) Precise Value per output (d) 0 ~ 10000
Set channel output type	(1) Specifies the outputs if the PLC system or I/O module operation is abnormal. (2) Following 4 outputs can be provided; (a) Former value Maintains the last output value in normal operation. (b) Minimum Outputs the minimum value of the output range. (c) Medium Outputs the medium value of the output range. (d) Maximum Outputs the maximum value of the output range.

2.5.5 Channel Output Type Setting Function

This function specifies the outputs corresponding to the PLC stop or error, or prohibited output.
The operating conditions specifying the output status for the respective mode are as follows.

(1) General mode

CPU	Module Output Status	Channel		Specified Status Value
		Operation	Stop	
RUN	Allowed	Digital data	0V	0: maintain former value 1: output minimum 2: output medium 3: output maximum
	Prohibited	According to the specified status value	0V	
STOP	Allowed	According to the specified status value	0V	
	Prohibited	According to the specified status value	0V	

E.g.) 1. If, PLC CPU (RUN), output channel (operation), channel output (allowed), output range (1~5V), specified channel output status (max.), digital data (4000) → Channel output value: 2V (outputs the digital input)
2. If, PLC CPU (RUN), output channel (operation), channel output (prohibited), output range (1~5V), specified channel output status (max.), digital data (4000) → Channel output value: 5V (outputs the specified status value)

(2) Test mode

CPU	Module Output Status	Channel		Specified Status Value
		Operation	Stop	
STOP	Allowed	Digital data	0V	0: maintain former value 1: output minimum 2: output medium 3: output maximum
	Prohibited	According to the specified status value	0V	

(3) In case of error

CPU	Module Output Status	Channel		Specified Status Value
		Operation	Stop	
RUN	Allowed	Note 1)	0V	0: maintain former value 1: output minimum 2: output medium 3: output maximum
	Prohibited	According to the specified status value	0V	
STOP	Allowed	According to the specified status value	0V	
	Prohibited	According to the specified status value	0V	
In case of H/W failure / Power On		0V		

Note 1) If setting exceeds upper output limit: upper limit
If setting is below lower output limit: lower limit
Erroneous parameter setting: according to the specified status value.

(4) In case of CPU error

CPU	Module Output Status	Channel		Remark
		Operation	Stop	
ERROR	Allowed	0V		-
	Prohibited			

Chapter 3 Installation and Wiring

3.1 Installation

3.1.1 Installation Environment

Although this device has high reliability regardless of the environment where it is mounted, pay attention to the following conditions for reliability and stability of the system.

(1) Environment conditions
- (a) Mount on a water-proof and vibration-proof controlling board.
- (b) Where there are no continuous shocks or vibrations
- (c) Where there is no direct sunlight
- (d) Where there is no condensation caused by sudden changes of the temperature
- (e) Where the temperature remains between 0-55.

(2) Installation work
- (a) Do not leave wiring remnants in the PLC when boring screws holes or doing wiring work.
- (b) Install in a place where you can easily manipulate it.
- (c) Do not install with a high voltage device in the same panel
- (d) Keep at least 50mm from a duct or module.
- (e) Connect to ground where the noise environment is good

3.1.2 Precautions in Handling

This section provides information on the precautions in from opening to installing the analog I/O module.

(1) Do not drop or hit hard

(2) Do not separate the PCB from the case. It may cause a failure.

(3) Be careful not to let foreign substances such as the wiring remnants in the upper part of the module when doing the wiring work.

(4) Do not mount or dismount when the power is on.

3.2 Wiring

3.2.1 Precautions in Wiring

(1) Do not put an AC power supply line near an external input signal line of an analog input module. Keep them apart enough not to be affected by the surge or induced noise from the AC side.

(2) Consider the surrounding temperature and allowed current when choosing the cable. A cable should be larger in maximum diameter than AWG22(0.3㎟).

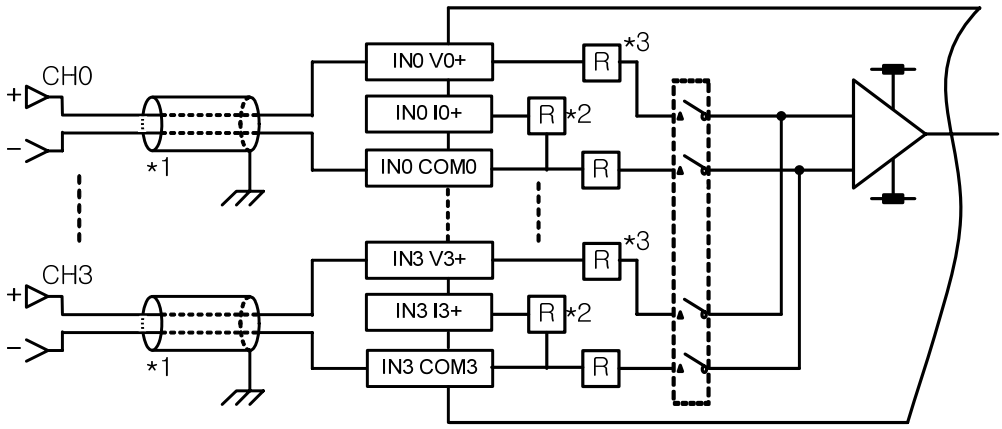
(3) If the cable is placed too close to a hot device or material or put in direct contact with oil, for example, it may cause a short circuit and result in damage or malfunction.

(4) Check the polarity when wiring the terminal block.

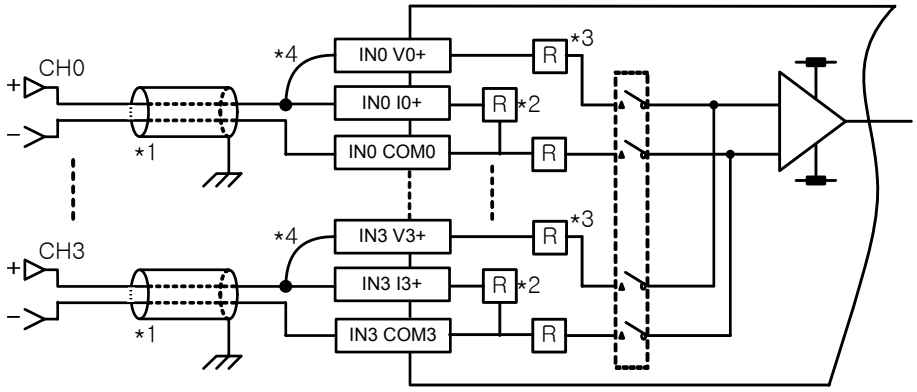
(5) When cables are wired with high voltage lines or power supply cords, an induction failure may occur resulting in malfunction or a failure.

3.2.2 An Example of Wiring

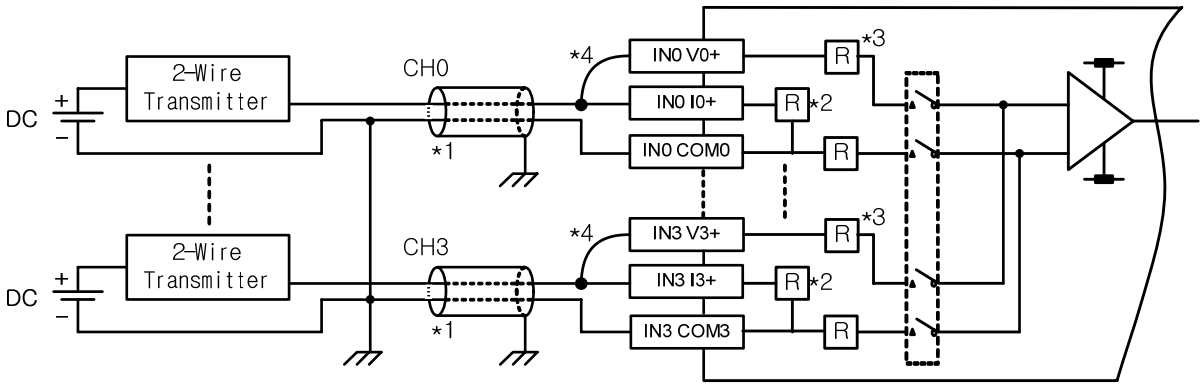
(1) Analog I/O module (voltage)



(2) Analog I/O module (current)



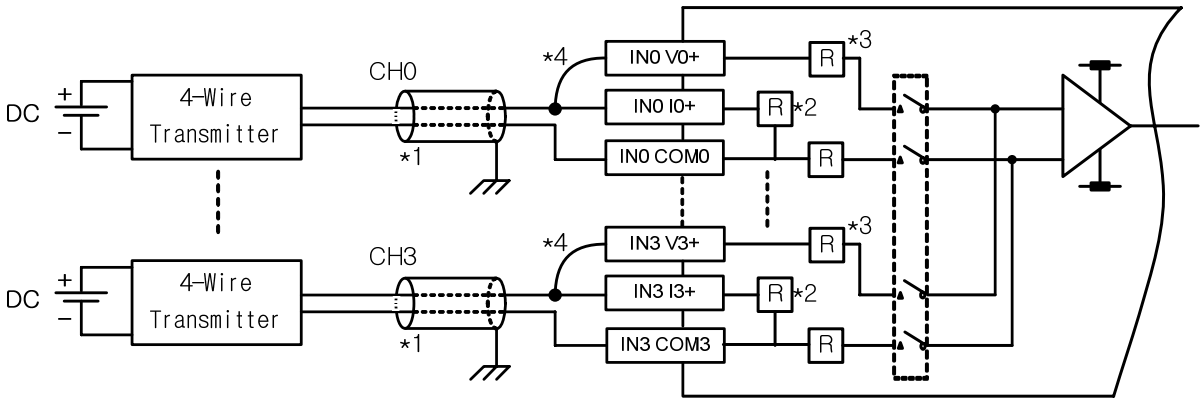
(3) An example of 2-wire sensor/transmitter wiring (current input)



(a) Set only the channel you are using.
(b) The analog I/O module does not provide power for input devices, such as a transmitter, which must use external power supply.

*1) Use 2 core twisted, shielded cable. AWG 22 cable is recommended.
*2) The input resistance to current input is 250 Ω (typ.).
*3) The input resistance to voltage input is 1 MΩ (min.).
*4) For current input, connect IN V+ and IN I+ terminals.

(4) An example of 4-wire sensor/transmitter wiring (current input)

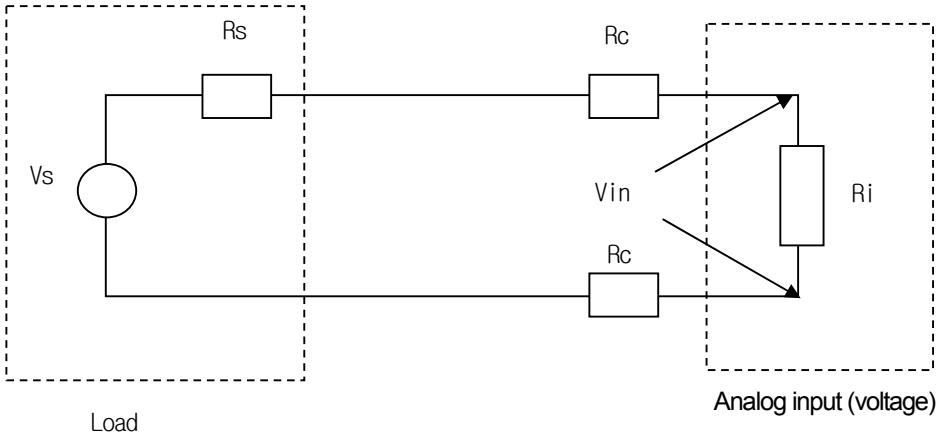


(a) Set only the channel you are using.
(b) The analog I/O module does not provide power for input devices, such as a transmitter, which must use external power supply.

*1) Use 2 core twisted, shielded cable. AWG 22 cable is recommended.
*2) The input resistance to current input is 250 Ω (typ.).
*3) The input resistance to voltage input is 1 MΩ (min.).
*4) For current input, connect IN V+ and IN I+ terminals.

(5) The relation between the voltage input precision and wiring length

In voltage input, the wiring length between the transmitter or sensor and the module affect the digital conversion values of the module as shown below.



In the figure,
Vs: analog output of the transmitter or sensor
Rs: internal resistance of the transmitter or sensor
Rc: resistance of the wire
Ri: internal resistance of the voltage input module (1㏁)
Vin: voltage applied to the analog input channel
% Vi: error (%) in the converted value caused by the source in voltage input and wire length

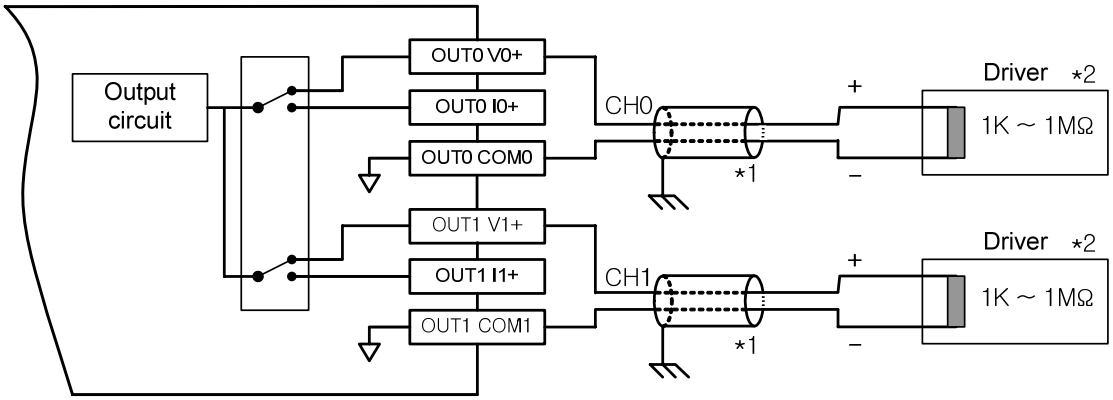
$$\%Vi = \left(1 - \frac{Vin}{Vs}\right) \times 100\,\%$$

Note

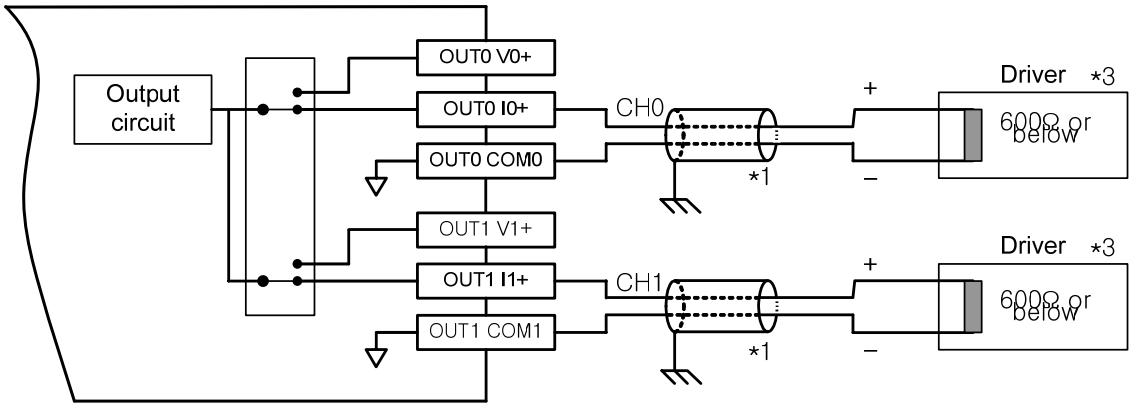
In current input, no error occurs by wiring length or the internal resistance of the source.

3.2.3 An Example of Output Wiring

(1) Voltage Output



(2) Current Output

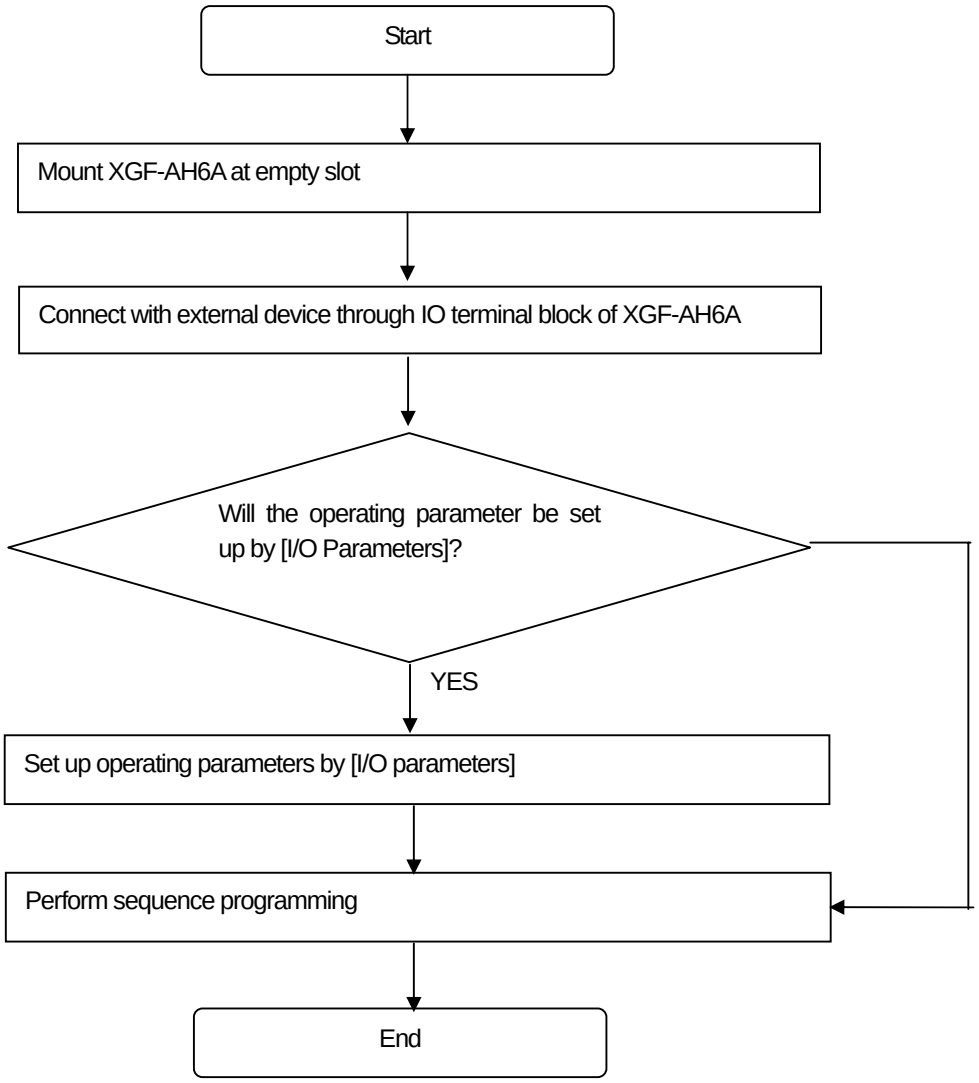


*1) Use 2 core twisted, shielded cable. AWG 22 cable is recommended.
*2) The input resistance of the drive receiving voltage output shall be 1K ~ 1MΩ.
*3) The input resistance of the drive receiving current output shall be 600Ω or below.

Chapter 4 Operating Setting and Monitor

4.1 The Operating Setting Flowchart

Fig. 4.1 illustrates the operating setting flowchart.


Start
Mount XGF-AH6A at empty slot
Connect with external device through IO terminal block of XGF-AH6A
Will the operating parameter be set up by [I/O Parameters]?
YES
Set up operating parameters by [I/O parameters]
Perform sequence programming
End

[Fig. 4. 1] Operating setting flowchart

4.2 Operating Parameter Setting

The operating parameters can be set in [I/O parameter] of XG 5000.

4.2.1 Setting Items

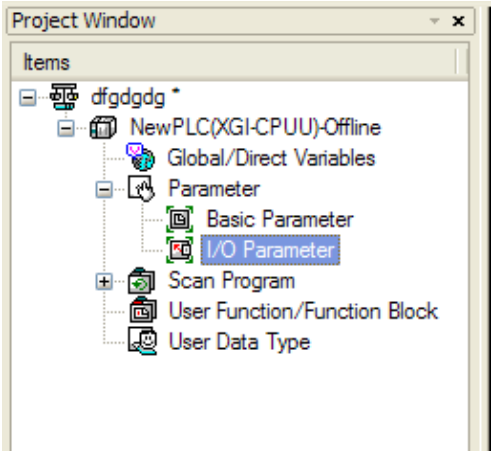
XG5000 provides GUI (Graphical User Interface) type in order to enhance the user's convenience. Table 4.1 shows the parameters that can be set through [I/O parameter] in the project window of XG5000.

[Table 4. 1] Functions of [I/O parameter]

Item	Description
Input Parameter	(1) Analog input channel run/stop setting (2) Analog input range setting (3) Digital output data type setting (4) Average processing method setting (5) Average value setting
Output Parameter	(1) Analog output channel run/stop setting (2) Analog output range setting (3) Digital input data type setting (4) Channel output status setting

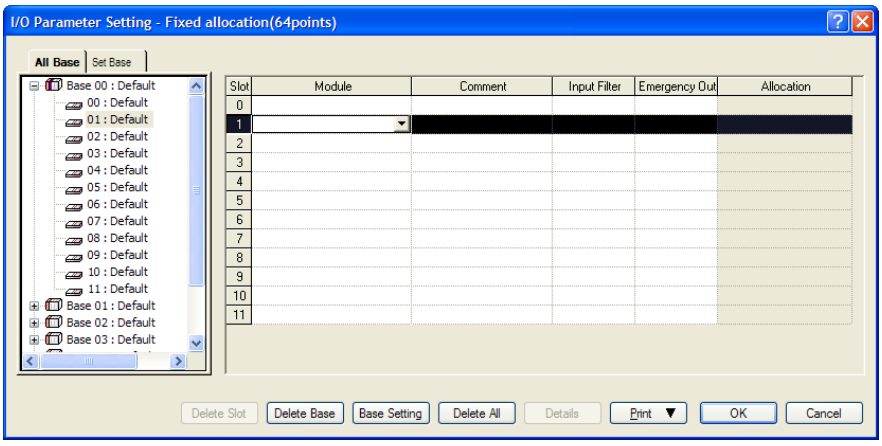
4.2.2 How to use [I/O Parameter]

(1) Start XG5000 and create a project.
(For how to create a project, see the manual of XG5000)
(2) Double-click the [I/O parameter] in the project window.



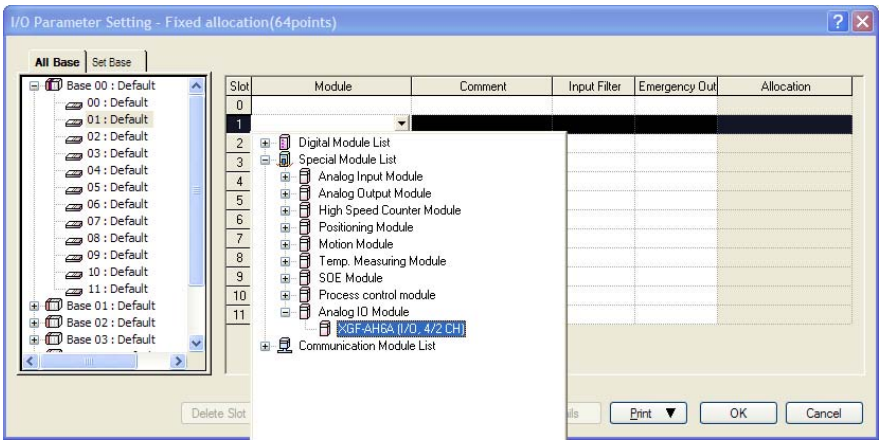
[Fig. 4. 2] Project Window

(3) Click on the slot of the base where the conversion module is mounted in the [I/O parameter setting] window. In this illustration, the analog I/O module is mounted in the No. 1 slot, No. 0 base.



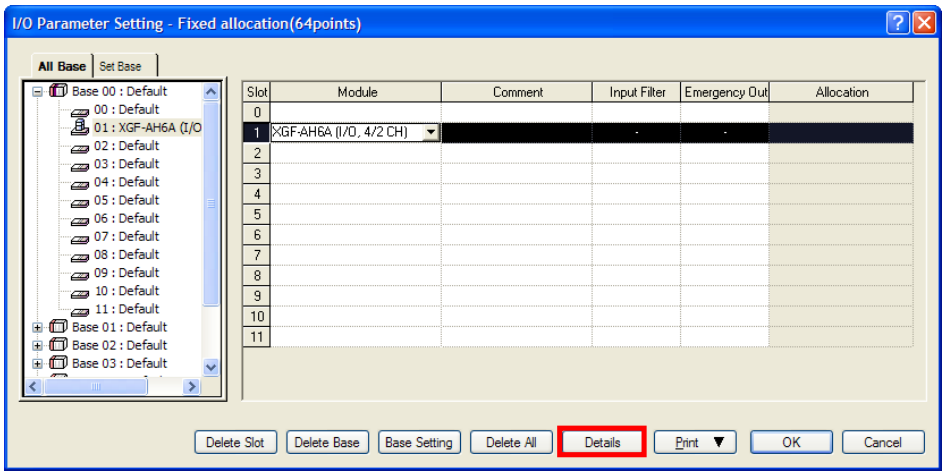
[Fig. 4. 3] I/O Parameter 1

(4) Click on the arrow button and then a window will appear where you can choose a module. Find and choose a desired module.



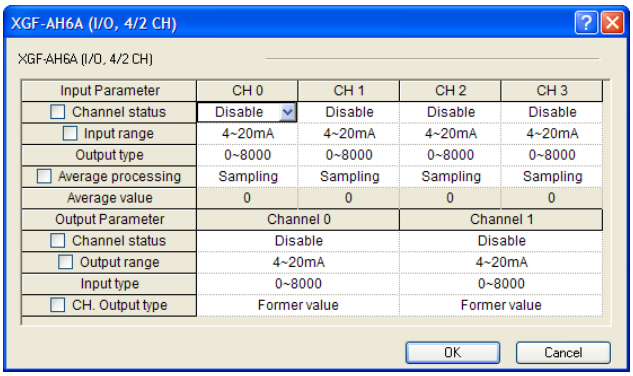
[Fig. 4. 4] I/O PARAMETER 2

(5) Click on [Detail] button with the module chosen.



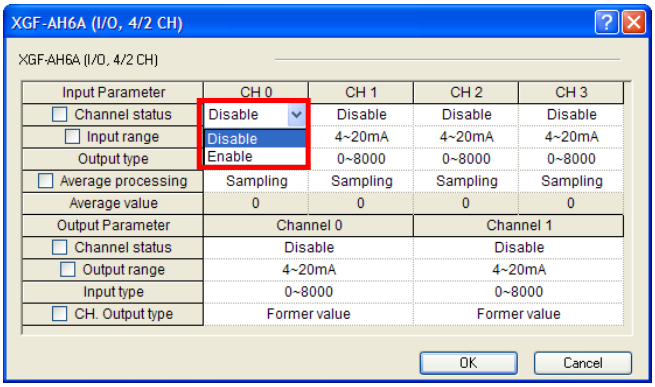
[Fig. 4. 5] I/O PARAMETER 3

(3) A window will appear where you can set the parameters for each channel as shown below. If you click on the item you want to set, the parameters that you can set will appear.

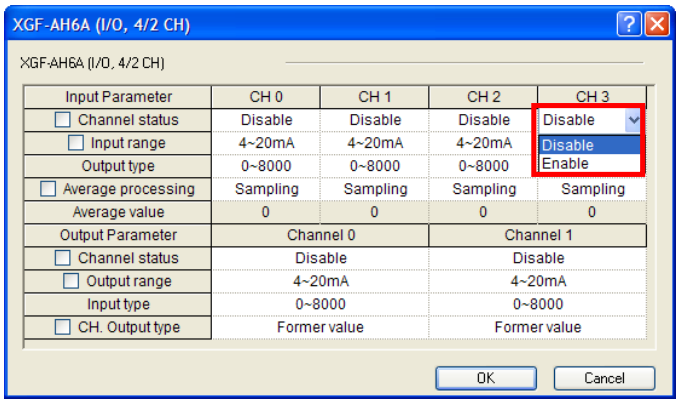


[Fig. 4. 6] Module Parameter

(a) Input Parameter Channel status: Disable or Enable

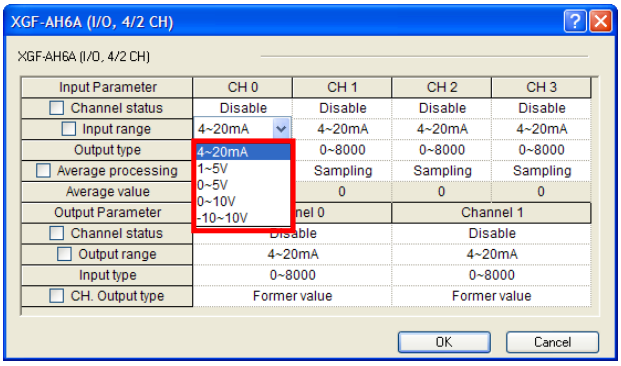


[Fig. 4. 7] Input Parameter 1

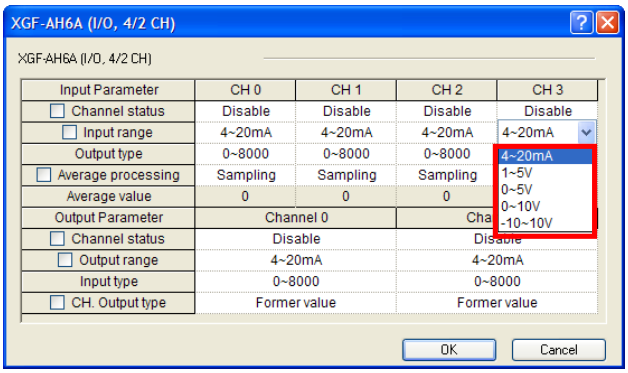


[Fig. 4. 8] Input Parameter 2

(b) Input parameter Input range: choose the range of the analog input you want to use. The analog I/O module provides 1 current input range and 4 voltage input ranges.

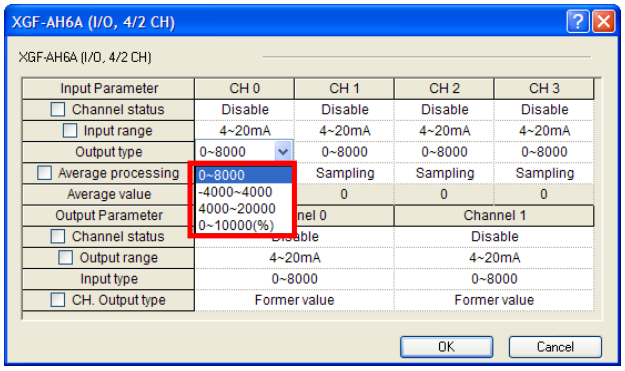


[Fig. 4. 9] Input Parameter 3

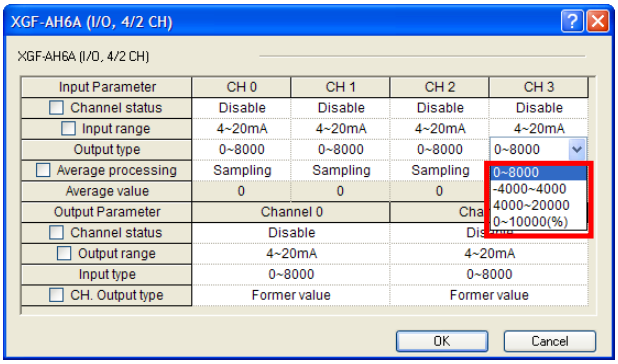


[Fig. 4. 10] Input Parameter 4

(c) The output type for input parameter: choose the output data type. You have 4 options.

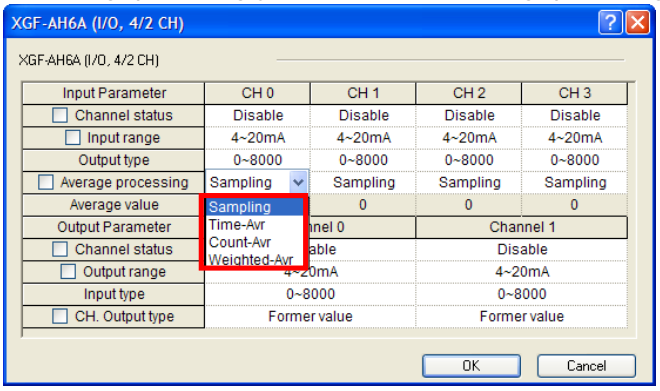


[Fig. 4. 11] Input Parameter 5

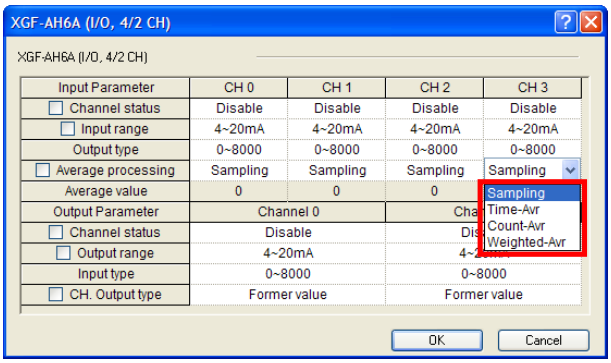


[Fig. 4. 12] Input Parameter 6

(d) Input parameter average processing: you can choose the average processing type. There are 4 options.

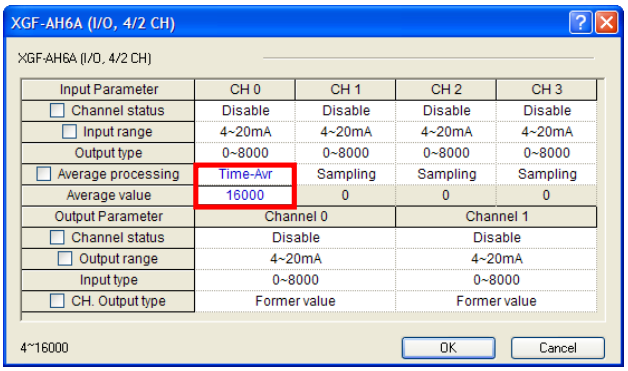


[Fig. 4. 13] Input Parameter 7

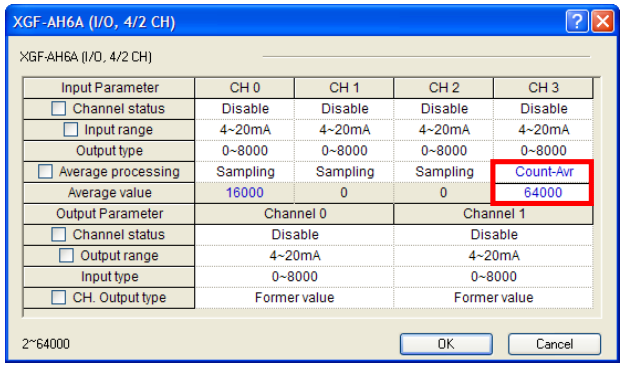


[Fig. 4. 14] Input Parameter 8

(e) Input parameter average value: you can enter the value in this field only when you have set average processing as the following three types (time, count and weighted averages), excluding the sampling processing. The range of the values you can enter in the field is respectively 4~16000, 2~64000 and 1~99 for time, count and weighted averages. Any values beyond the ranges cannot be entered.

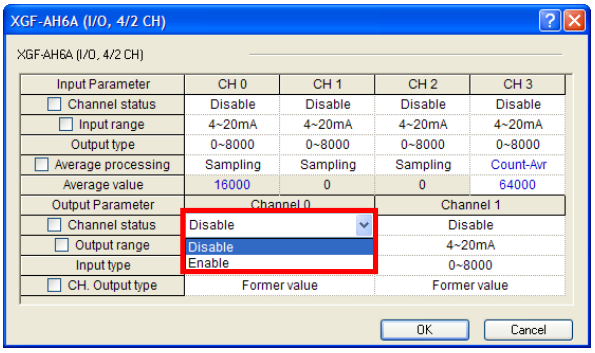


[Fig. 4. 15] Input Parameter 9

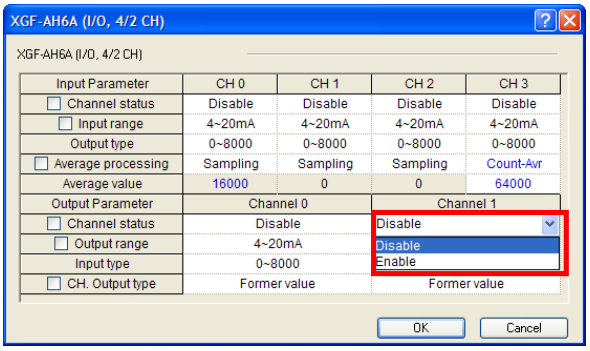


[Fig. 4. 16] Input Parameter 10

(f) Output parameter channel status: Disable or Enable

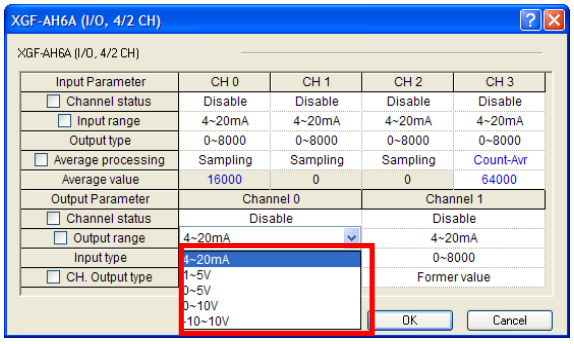


[Fig. 4. 17] Output Parameter 1

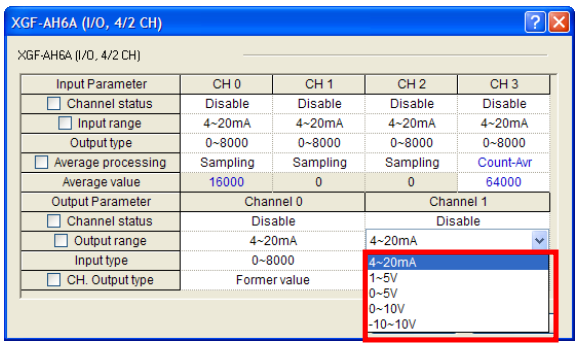


[Fig. 4. 18] Output Parameter 2

(g) Output parameter output range: choose the range of the analog output you want to use. The analog I/O module provides 1 current output range and 4 voltage output ranges.

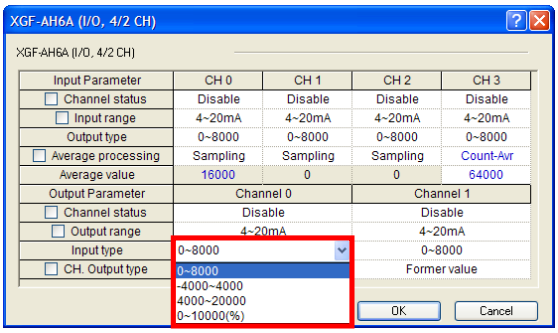


[Fig. 4. 19] Output Parameter 3

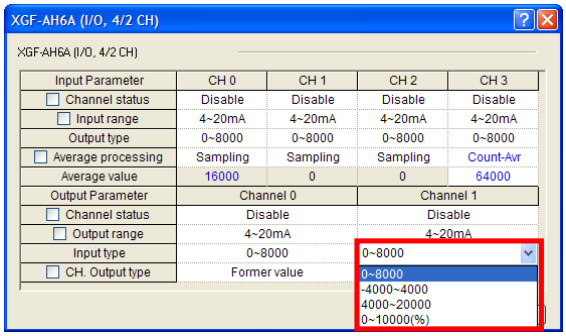


[Fig. 4. 20] Output Parameter 4

(h) Output parameter input type: choose the input type. You have 4 options.

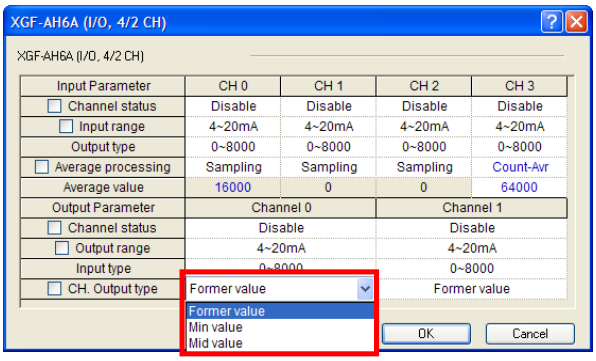


[Fig. 4. 21] Output Parameter 5

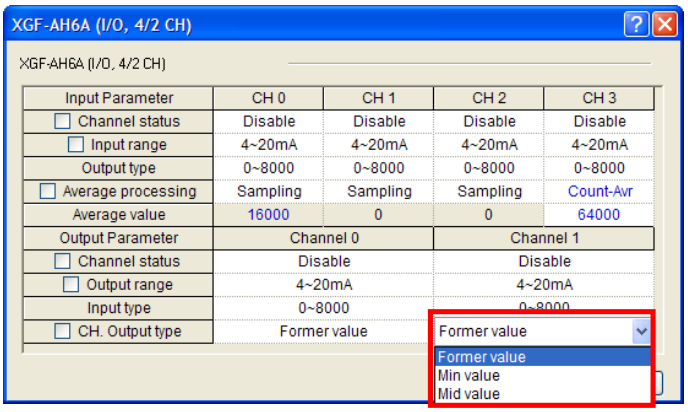


[Fig. 4. 22] Output Parameter 6

(i) Output parameter CH output type: defines the output status when the PLC system is not in normal operation. Four output statuses are supported. The former value will maintain the last output value in normal operation. The minimum, medium, or maximum value will output the minimum, medium or maximum value in the output range, respectively.

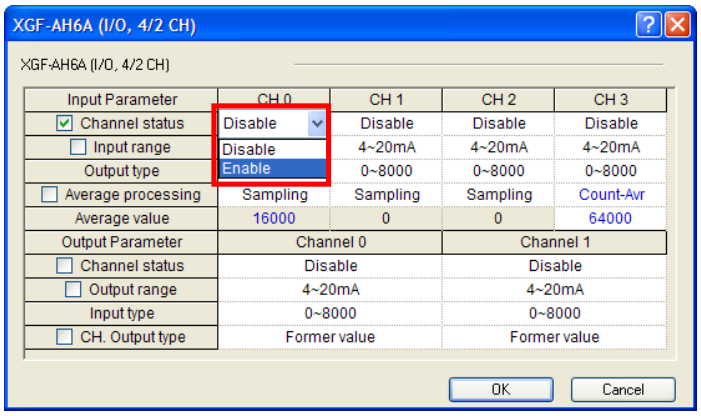


[Fig. 4. 23] Output Parameter 7

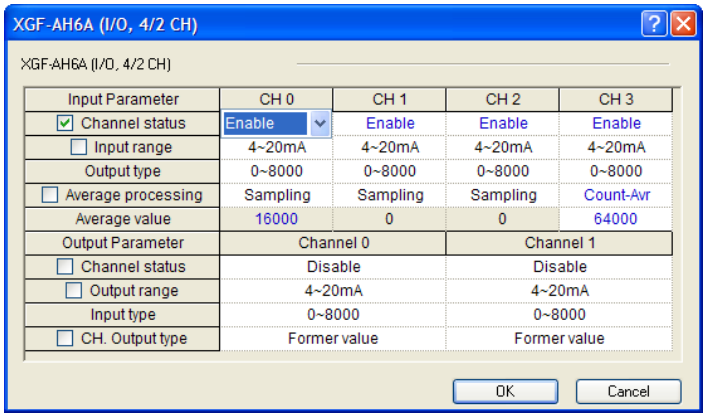


[Fig. 4. 24] Output Parameter 8

(j) Select and change all Channel status: If you want to change all the channels to the same set value, check the radio button in the parameter row. Then, if you change the parameter of a channel, the parameters of all the channels will change at the same time.



[Fig. 4. 25] Change all channel parameters 1

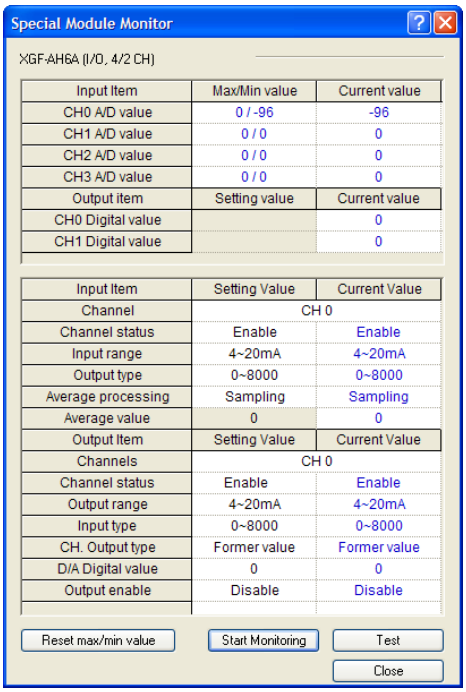


[Fig. 4. 26] Change all channel parameters 2

4.3 Functions of the Special Module Monitor

4.3.1 Special Module Monitor

The special module monitor function of the XG5000 enables to check the operation of the module.



[Fig. 4. 27] Special Module Monitor 1

The functions of the special module monitor are as follows.

(1) Parameter setting
User can set up temporary setting value can be set in the I/O Parameter to test module operation.

(2) Monitor the current operating information of the module
User can monitor the current set-up condition and operating data of the module.

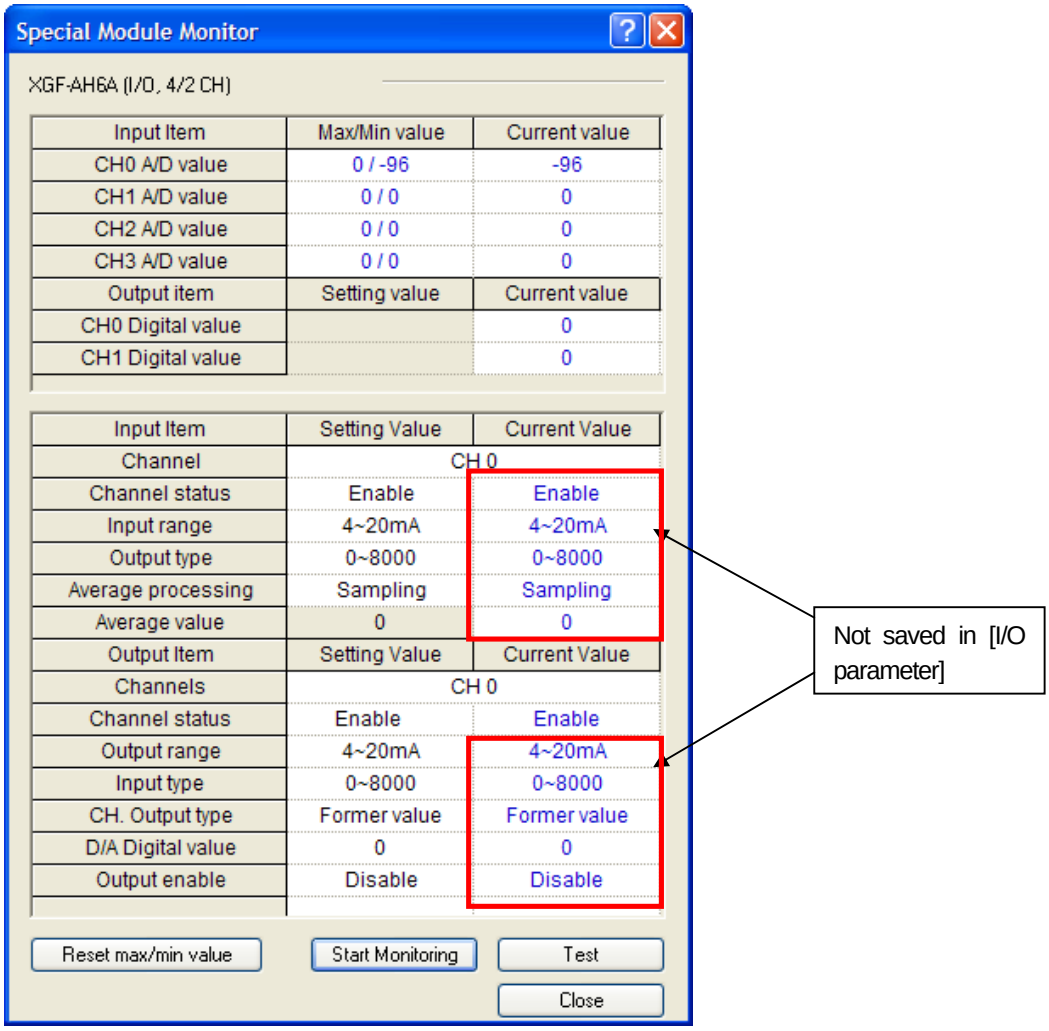
(3) Monitor maximum/minimum values of input
For input channel, user can monitor the history of the maximum/minimum values of input data.

Note

The display may be abnormal if system resource is insufficient. In such case, close the window, exit other applications and run XG5000 again.

4.4 Precautions

(1) The parameters you set to test the analog I/O module in the [Special module monitor] window are gone as soon as the [Special module monitor] window is closed. That is, the parameters of the module set in the [Special module monitor] window are not saved in [I/O Parameter] on the left tab of XG5000.


Special Module Monitor
XGF-AH6A (I/O, 4/2 CH)
Input Item | Max/Min value | Current value
CH0 A/D value | 0 / -96 | -96
CH1 A/D value | 0 / 0 | 0
CH2 A/D value | 0 / 0 | 0
CH3 A/D value | 0 / 0 | 0
Output item | Setting value | Current value
CH0 Digital value | | 0
CH1 Digital value | | 0
Input Item | Setting Value | Current Value
Channel | CH 0
Channel status | Enable | Enable
Input range | 4~20mA | 4~20mA
Output type | 0~8000 | 0~8000
Average processing | Sampling | Sampling
Average value | 0 | 0
Output Item | Setting Value | Current Value
Channels | CH 0
Channel status | Enable | Enable
Output range | 4~20mA | 4~20mA
Input type | 0~8000 | 0~8000
CH. Output type | Former value | Former value
D/A Digital value | 0 | 0
Output enable | Disable | Disable
Reset max/min value
Start Monitoring
Test
Close
Not saved in [I/O parameter]

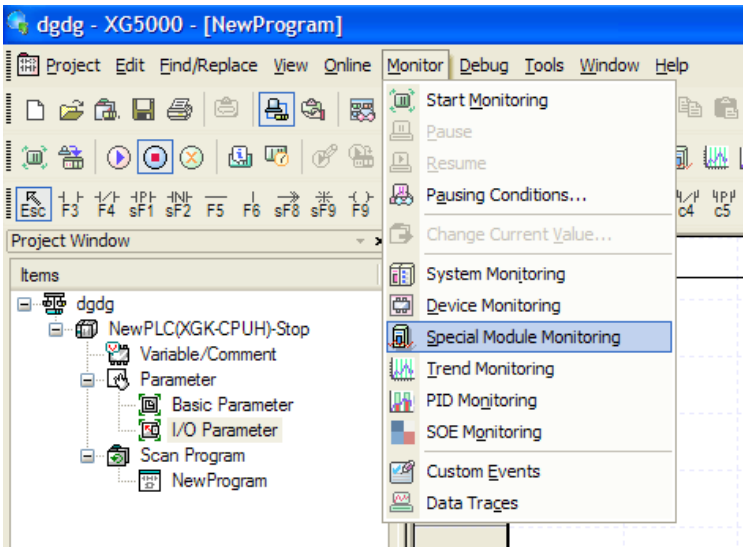
[Fig. 4. 28] Special Module Monitor 2

(2) The test function of the [Special module monitor] is for checking whether the analog I/O module operates normally when no sequence program has been programmed. If you use the analog I/O module for other purposed than testing, it is recommended you use the parameter setting function in [I/O parameter].

4.5 How to Use the Special Module Monitor

4.5.1 Starting [Special module monitoring]

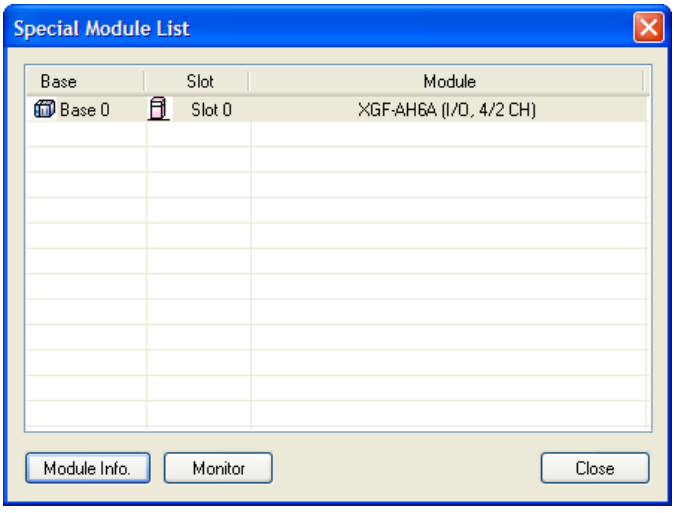
Go [Online] -> [Connect], and then [Monitor] -> [Special module monitoring]. If you are not in the [Online] status, the [Special module monitoring] menu will not be activated.



[Fig. 4. 29] Monitor Menu

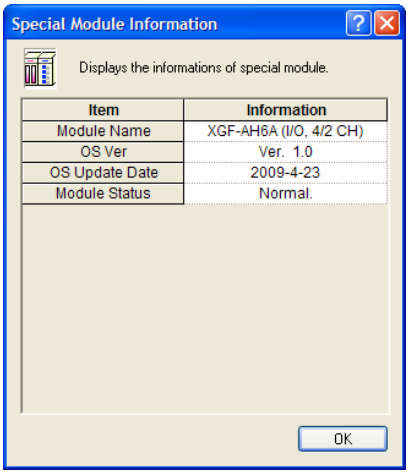
4.5.2 How to Use [Special module monitoring]

(1) Click on [Monitor] -> [Special module monitoring] with XG5000 connected to the PLC CPU module. Then the 'special module list' window will appear displaying the base/slot information along with the types of the special module as in [Fig. 5.1]. The list dialog displays the module currently mounted in the PLC system.



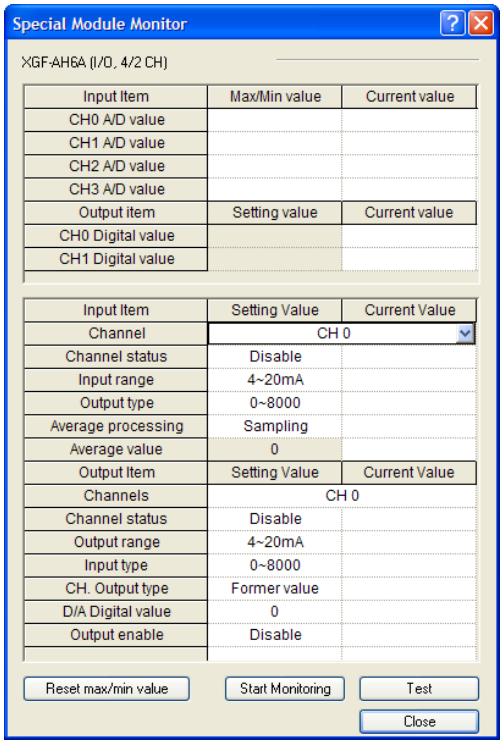
[Fig. 4. 30] Special Module List

(2) Select the special module and click on [Module information]. Special module information will be displayed.



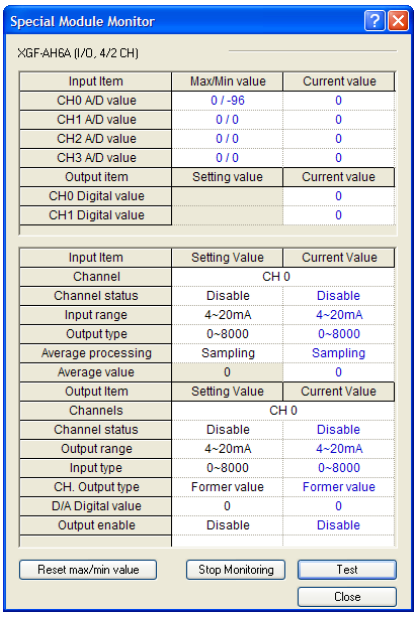
[Fig. 4. 31] Special Module Information

(3) Click on the [Monitor] button in the [Special module list]. The [Special module monitor] window will appear. There are 4 buttons of [Reset max/min value], [Start monitoring], [Test] and [Close] in this window. The monitor at the top of the screen displays the outputs of the analog I/O module and maximum/minimum values. In the test window at the bottom of the screen, you can configure the parameter items of each module discretely.



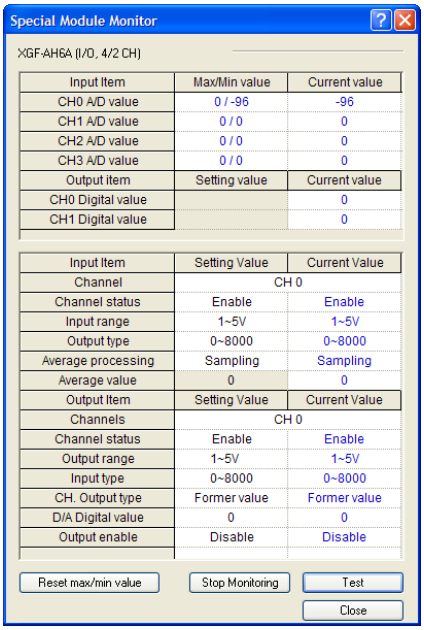
[Fig. 4. 32] Special Module Monitor 1

(a) [Start monitor]: If you clink on [Start monitor], the A/D and D/A conversion value of the currently running channel will be displayed. [Fig. 4.33] is the monitoring screen that you see when status of all channel are disabled. The current value field at the bottom of the window displays the currently set parameter of the analog I/O module.


Special Module Monitor
XGF-AH6A (I/O, 4/2 CH)
Input Item | Max/Min value | Current value
CH0 A/D value | 0 / -96 | 0
CH1 A/D value | 0 / 0 | 0
CH2 A/D value | 0 / 0 | 0
CH3 A/D value | 0 / 0 | 0
Output item | Setting value | Current value
CH0 Digital value | | 0
CH1 Digital value | | 0
Input Item | Setting Value | Current Value
Channel | CH 0
Channel status | Disable | Disable
Input range | 4~20mA | 4~20mA
Output type | 0~8000 | 0~8000
Average processing | Sampling | Sampling
Average value | 0 | 0
Output Item | Setting Value | Current Value
Channels | CH 0
Channel status | Disable | Disable
Output range | 4~20mA | 4~20mA
Input type | 0~8000 | 0~8000
CH. Output type | Former value | Former value
D/A Digital value | 0 | 0
Output enable | Disable | Disable
Reset max/min value
Stop Monitoring
Test
Close

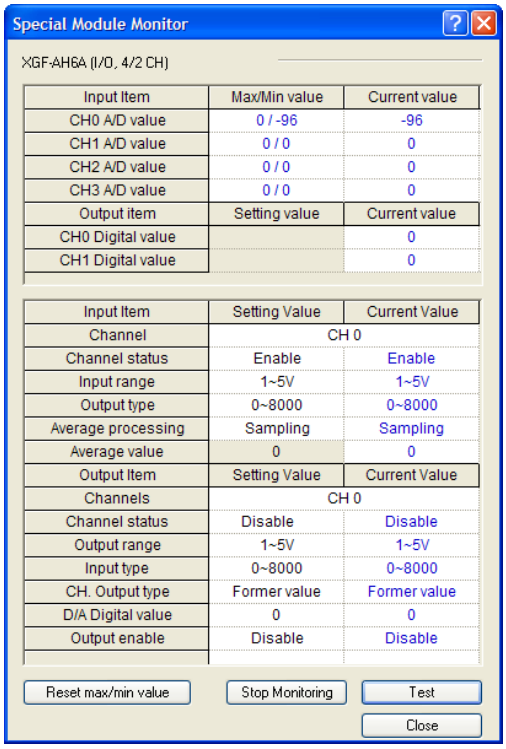
[Fig. 4. 33] Special Module Monitor 2

(b) [Test]: [Test] is used when you want to change the currently set parameter of the analog I/O module. You can change the parameter by clicking on the set value in the field at the bottom of the window. [Fig. 4.34] is when you execute [Test] after changing the input range of channel 0 to 1~5V without wiring the input.


Special Module Monitor
XGF-AH6A (I/O, 4/2 CH)
Input Item | Max/Min value | Current value
CH0 A/D value | 0 / -96 | -96
CH1 A/D value | 0 / 0 | 0
CH2 A/D value | 0 / 0 | 0
CH3 A/D value | 0 / 0 | 0
Output item | Setting value | Current value
CH0 Digital value | | 0
CH1 Digital value | | 0
Input Item | Setting Value | Current Value
Channel | CH 0
Channel status | Enable | Enable
Input range | 1~5V | 1~5V
Output type | 0~8000 | 0~8000
Average processing | Sampling | Sampling
Average value | 0 | 0
Output Item | Setting Value | Current Value
Channels | CH 0
Channel status | Enable | Enable
Output range | 1~5V | 1~5V
Input type | 0~8000 | 0~8000
CH. Output type | Former value | Former value
D/A Digital value | 0 | 0
Output enable | Disable | Disable
Reset max/min value
Stop Monitoring
Test
Close

[Fig. 4. 34] Special Module Monitor 3

(c) [Reset max/min value]: the max/min field on top of the screen shows the maximum and minimum conversion values of the analog I/O module. If you clink on it, the maximum and minimum values are reset. [Fig. 4.35] is when you click on [Reset max/min]. You can see that the A/D conversion value of channel 0 has been reset.



[Fig. 4. 35] Special Module Monitor 4

4.6 Automatic Registration of U Device

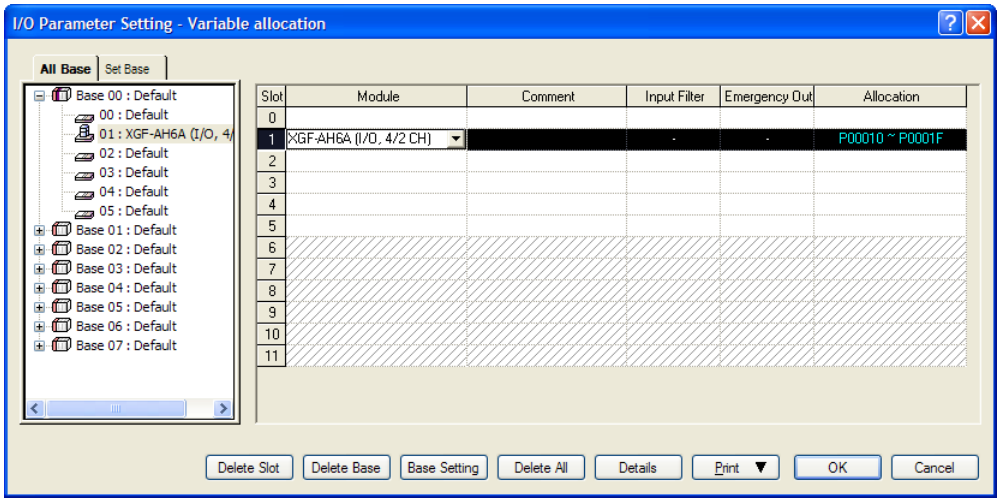
This section provides information on the automatic registration of U device of XG5000.

4.6.1 Automatic Registration of U Device

The variables for each module are automatically registered referring to the information of the special module set in [I/O parameter]. The user can modify the variables and the descriptions. The description below is based on the XGK CPU.

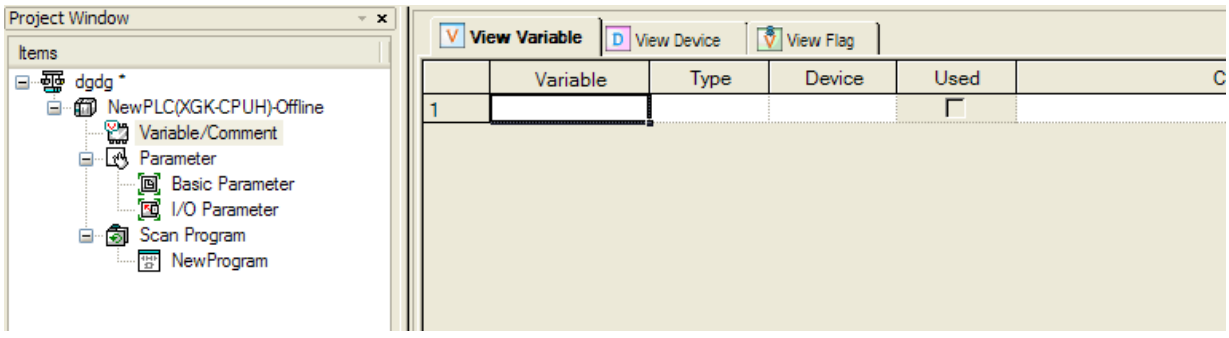
[Sequence]

(1) Set the special module in [I/O parameter].



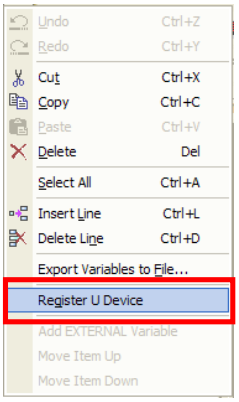
[Fig. 4. 36] I/O Parameter Setting

(2) Double-click on [Variable/Comment]. (For XGI/XGR CPU, click on the [Global/Direct variables]).



[Fig. 4. 37] Variable Registration 1

(3) Choose 'Register U device' in [Edit] in the menu. (For XGI/XGR, select the [Register Special/Communication Module Variables].)



[Fig. 4. 38] Variable Registration 2

(4) Select 'Yes.'

XG5000
Automatically register comments in the U Devices according to the special module set in the I/O parameter.
The previous comment will be deleted.
Continue?
Yes
No

[Fig. 4. 39] Variable Registration 3

(5) Variables are registered as shown below.

View Variable | View Device | View Flag

	Variable	Type	Device	Used	Comment
1	_01_AD0_ERR	BIT	U01.00.0	☐	Analog IO Module: Input CH0 Error
2	_01_AD1_ERR	BIT	U01.00.1	☐	Analog IO Module: Input CH1 Error
3	_01_AD2_ERR	BIT	U01.00.2	☐	Analog IO Module: Input CH2 Error
4	_01_AD3_ERR	BIT	U01.00.3	☐	Analog IO Module: Input CH3 Error
5	_01_DA0_ERR	BIT	U01.00.4	☐	Analog IO Module: Output CH0 Error
6	_01_DA1_ERR	BIT	U01.00.5	☐	Analog IO Module: Output CH1 Error
7	_01_RDY	BIT	U01.00.F	☐	Analog IO Module: Module Ready
8	_01_AD0_ACT	BIT	U01.01.0	☐	Analog IO Module: Input CH0 Active
9	_01_AD1_ACT	BIT	U01.01.1	☐	Analog IO Module: Input CH1 Active
10	_01_AD2_ACT	BIT	U01.01.2	☐	Analog IO Module: Input CH2 Active
11	_01_AD3_ACT	BIT	U01.01.3	☐	Analog IO Module: Input CH3 Active
12	_01_DA0_ACT	BIT	U01.01.4	☐	Analog IO Module: Output CH0 Active
13	_01_DA1_ACT	BIT	U01.01.5	☐	Analog IO Module: Output CH1 Active
14	_01_AD0_IDD	BIT	U01.06.0	☐	Analog IO Module: Input CH0 Disconnection Flag
15	_01_AD1_IDD	BIT	U01.06.1	☐	Analog IO Module: Input CH1 Disconnection Flag
16	_01_AD2_IDD	BIT	U01.06.2	☐	Analog IO Module: Input CH2 Disconnection Flag
17	_01_AD3_IDD	BIT	U01.06.3	☐	Analog IO Module: Input CH3 Disconnection Flag
18	_01_ERR_CLR	BIT	U01.07.0	☐	Analog IO Module: Error Clear Request
19	_01_DA0_OUTE	BIT	U01.08.0	☐	Analog IO Module: Output CH0 Status Setting

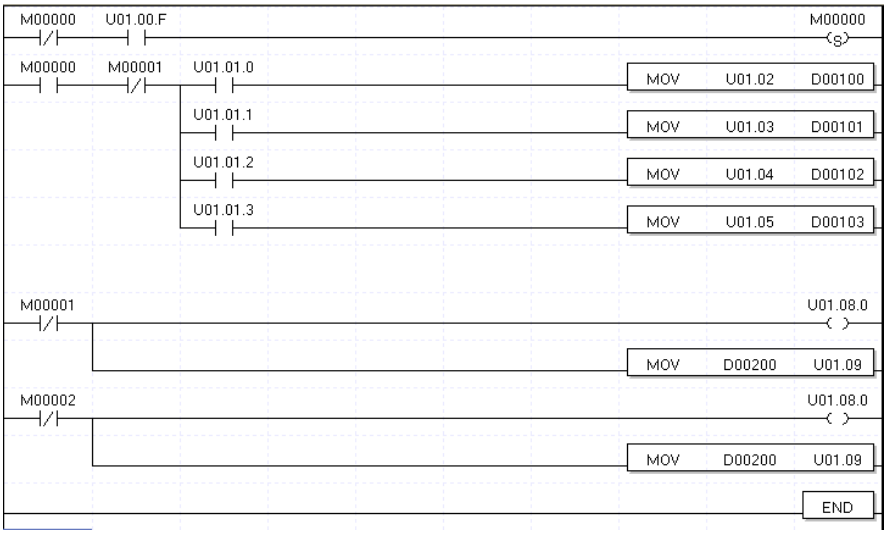
[Fig. 4. 40] Variable Registration 4

4.6.2 Saving Variables

(1) The content in the 'View Variable' tab can be saved in text files.
(2) Click on 'Export Variable to File' in 'Edit' in the menu.
(3) The content in the 'View Variable' tab is saved in a text file.

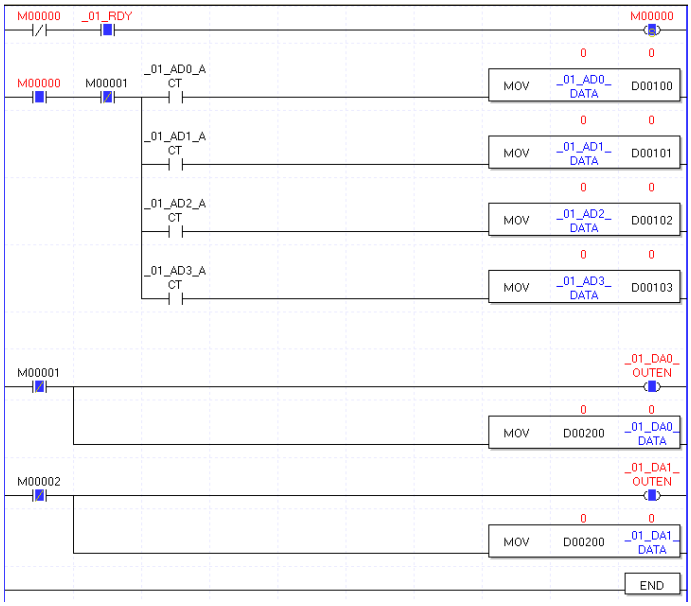
4.6.3 Viewing Variables in the Program

(1) The example program of XG5000 is as follows.



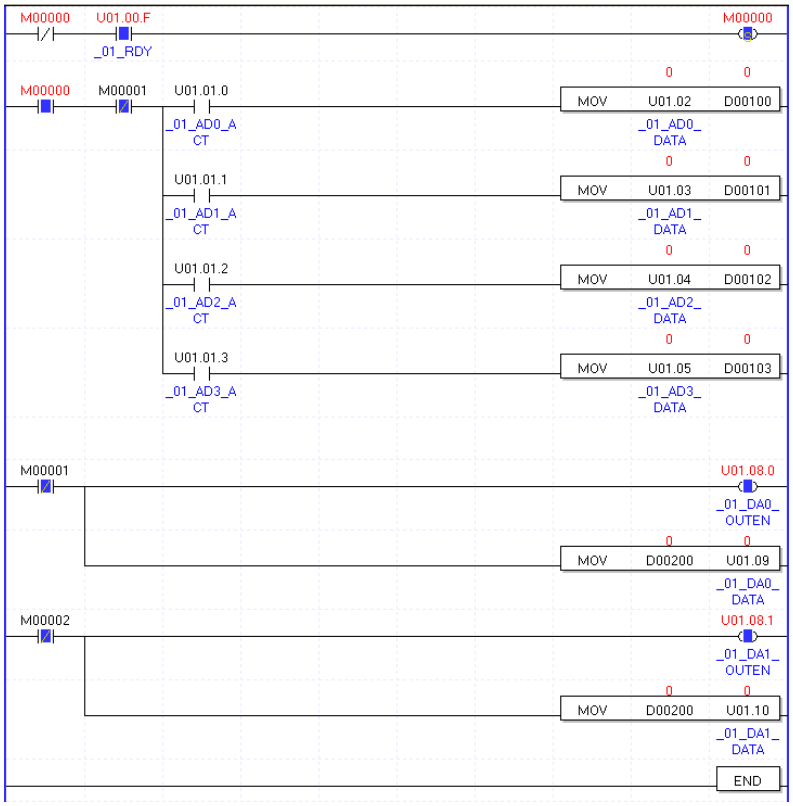
[Fig. 4. 41] View Variables 1

(2) Click on 'Variable' in 'View' in the menu. Some devices of which variable are already defined changes into variables.



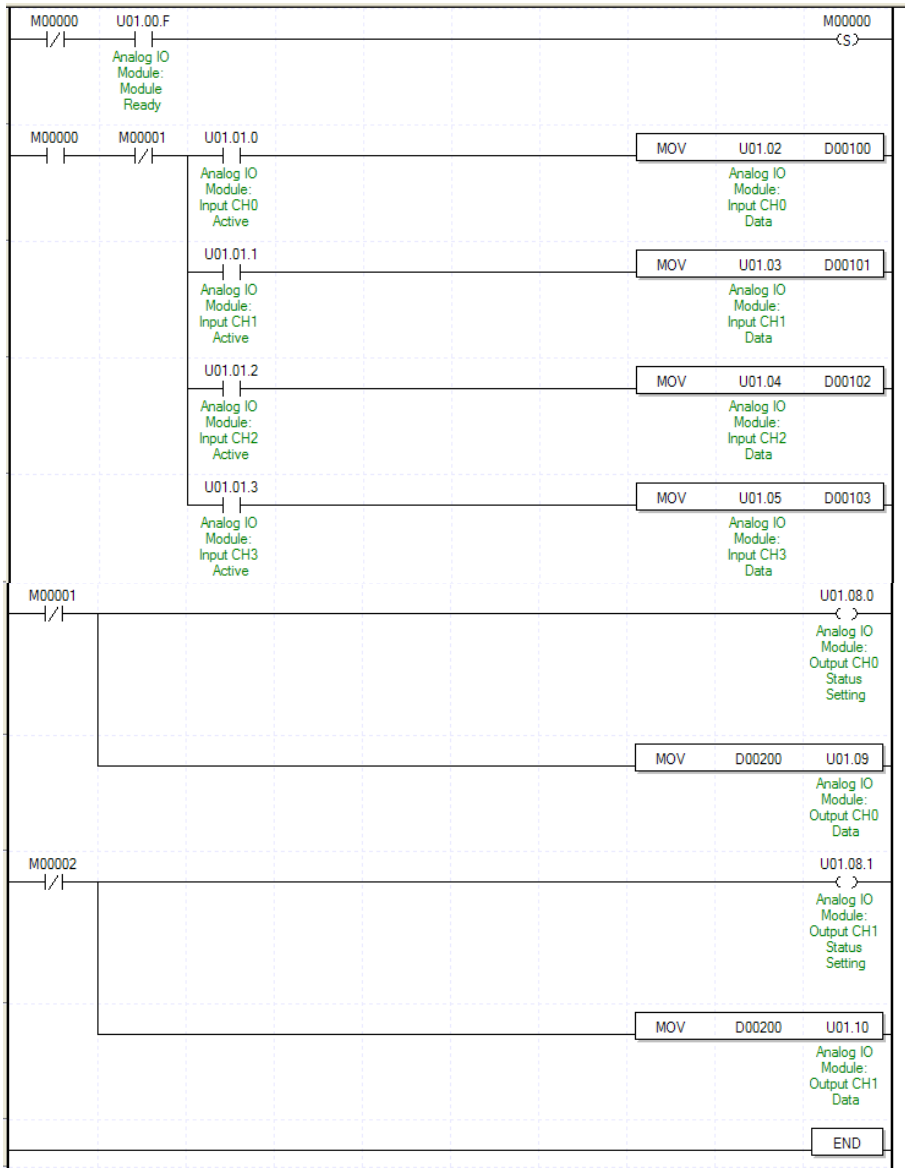
[Fig. 4. 42] View Variables 2

(3) Click on 'Devices/Variables' in 'View' in the menu. You can view the device and variable together at a time.



[Fig. 4. 43] View Variables 3

(4) Click on 'Devices/Comments' in 'View' in the menu. You can view the device and description together at a time.



[Fig. 4. 44] View Variables 4

Chapter 5 Configuration and Functions of the Internal Memory (XGK)

The analog I/O module has an internal memory for transmitting and receiving data with the PLC CPU.

5.1 The Configuration of the Internal Memory

This section gives information on the configuration of the internal memory.

5.1.1 Input and Output Memory Areas

[Table 5.1] presents the I/O memory areas of the analog I/O module.

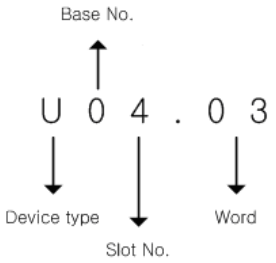
[Table 5. 1] I/O Memory Areas

Device	Variable	Description
UXY.00.0	_XY_AD0_ERR	Input channel 0 error (R)
UXY.00.1	_XY_AD1_ERR	Input channel 1 error (R)
UXY.00.2	_XY_AD2_ERR	Input channel 2 error (R)
UXY.00.3	_XY_AD3_ERR	Input channel 3 error (R)
UXY.00.4	_XY_DA0_ERR	Output channel 0 error (R)
UXY.00.5	_XY_DA1_ERR	Output channel 1 error (R)
UXY.00.F	_XY_RDY	Module Ready (R)
UXY.01.0	_XY_AD0_ACT	Input channel 0 active (R)
UXY.01.1	_XY_AD1_ACT	Input channel 1 active (R)
UXY.01.2	_XY_AD2_ACT	Input channel 2 active (R)
UXY.01.3	_XY_AD3_ACT	Input channel 3 active (R)
UXY.01.4	_XY_DA0_ACT	Output channel 0 active (R)
UXY.01.5	_XY_DA1_ACT	Output channel 1 active (R)
UXY.06.0	_XY_AD0_IDD	Input channel 0 Disconnection flag (R)
UXY.06.1	_XY_AD1_IDD	Input channel 1 Disconnection flag (R)
UXY.06.2	_XY_AD2_IDD	Input channel 2 Disconnection flag (R)
UXY.06.3	_XY_AD3_IDD	Input channel 3 Disconnection flag (R)
UXY.07.0	_XY_ERR_CLR	Error clear Request (W)
UXY.08.0	_XY_DA0_OUTEN	Output Channel 0 State setting (W)
UXY.08.1	_XY_DA1_OUTEN	Output Channel 1 State setting (W)
UXY.02	_XY_AD0_DATA	Input channel 0 data (R)
UXY.03	_XY_AD0_DATA	Input channel 1 data (R)
UXY.04	_XY_AD0_DATA	Input channel 2 data (R)
UXY.05	_XY_AD0_DATA	Input channel 3 data (R)
UXY.09	_XY_DA0_DATA	Output channel 0 data (W)
UXY.10	_XY_DA1_DATA	Output channel 1 data (W)

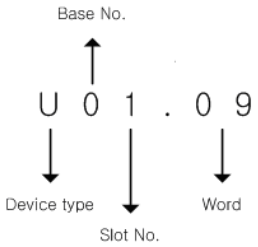
* (R), (W) means Read, Write respectively.

(1) In the device allocation, 'X' and 'Y' stand for the base and slot numbers of the module.

(2) The "Input channel 1 data" of the analog I/O module mounted in base 0 slot 4 is expressed as U04.03.



(3) The "Output channel 0 data" of the analog I/O module mounted in base 0 slot 1 is expressed as U01.09.



5.1.2 Operating Parameter Setting Area

[Table 5.2] shows the operating parameter setting area of the analog I/O input module.

[Table 5. 2] Operating parameter setting ranges

Memory address	Symbol	Description
0	F1_CH_EN	Specifies the channel to use (W)
1	F1_AD_RANGE	Input voltage/current ranges (W)
2	F1_DA_RANGE	Output voltage/current ranges 2 (W)
3	F1_DATA_TYPE	I/O data type (W)
4	F1_AVG_SEL	Input averaging method (W)
5	F1_AD0_AVG_VAL	Input channel 0 average (W)
6	F1_AD1_AVG_VAL	Input channel 1 average (W)
7	F1_AD2_AVG_VAL	Input channel 2 average (W)
8	F1_AD3_AVG_VAL	Input channel 3 average (W)
9	F1_IDLE_OUT	Channel output State (W)
13	F1_ERR_COD	Error code (R)

5.2 Data Input/Output Area of the Analog I/O Module

5.2.1 Module READY/ERROR flag (UXY.00)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	RDY	-									DA1	DA0	AD3	AD2	AD1	AD0

RDY

State	Description
0	Module stop
1	Module run

ADx / DAx (x: Input/Output channel No.)

State	Description
0	Normal
1	The channel is in error

5.2.2 Operating channel flag (UXY.01)

This is the area where the operating information for each I/O channel is stored.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-										DA1	DA0	AD3	AD2	AD1	AD0

ADx / DAx (x: Input/Output channel No.)

State	Description
0	Channel stop
1	Channel run

5.2.3 Digital output value (UXY.02 ~ UXY.05)

(1) The A/D converted digital output value is outputted for each channel in the buffer memory address 2 ~ 5(UXY.02 ~ UXY.05).

(2) The digital output values are saved in binary numbers of 16 bit.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0x0000															
Variable Name	ADx_DATA															

Where the converted data of the Input channel x is saved.

5.2.4 Disconnection Detection flag (UXY.06)

(1) The disconnection detection signal of each input channel is stored in UXY.06.

(2) Each bit is set as 1 when a disconnection is detected for the allocated channel, and turns into 0 when the disconnection is recovered. Each bit can be used for disconnection detection in the user program as the operating conditions.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-												AD3	AD2	AD1	AD0

ADx (x: input channel No.)

State	Description
0	Normal
1	Disconnected

5.2.5 Error clear request flag (UXY.07)

(1) When there is a parameter setting error, the error code of address 13 may not be automatically deleted even if you change the parameter to a correct value. If you turn on the error clear request bit, the error code of the address 13 and the error displayed in the [System Monitoring] of XG5000 is deleted. RUN LED also turns to On from flashing.

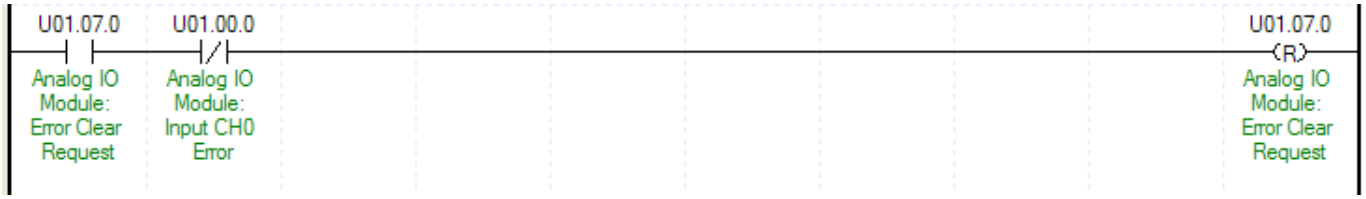
(2) You have to use the error clear request flag along with UXY.00.0~UXY.00.5 (Error flag) for normal operating as shown in [Fig. 5.1]

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-															ECLR_REQ

⇩

Error clear request flag (UXY.07.0)

Bit ON (1): error clear request, Bit Off (0): error clear stand-by



[Fig. 5. 1] How to use the error clear request flag

5.2.6 Allow analog output (UXY.08)

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-														DA1	DA0

DAx (x: Output channel No.)

State	Description
0	Prohibit channel output
1	Allow channel output

5.2.7 Analog output value (UXY.09 ~ UXY.10)

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0x0000															
Variable Name	DAx_DATA															

Where the user sets the conversion data of the output channel x

5.3 Operating Parameter Setting Area

▶ Each address of the internal memory occupies 1 word, which can be expressed in 16 bit.

5.3.1 Designation of the channel to use (address 0)

(1) You can set whether to enable/disable A/D conversion for each channel.
(2) You can shorten the conversion cycle for channels by disabling conversion of the channel you don't use.
(3) When no channel is designated for use, all the channels are set as not used.
(4) Enable/Disable of analog I/O conversion is as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-										DA1	DA0	AD3	AD2	AD1	AD0

ADx / DAx (x: I/O channel No.)

State	Description
0	Stop
1	Run

5.3.2 Input Voltage/Current Ranges (Address 1)

(1) You can set the ranges of the analog I/O input voltage/current for each channel.
(2) When no analog input range is specified, all the channels are set as 4 ~ 20 mA.
(3) The ranges of analog input voltage/current settings are as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0000				0000				0000				0000			
Variable Name	AD3				AD2				AD1				AD0			

ADx (x: Input channel No.)

State	Description
0000	4 ~ 20 ㎃
0010	1 ~ 5 V
0011	0 ~ 5 V
0100	0 ~ 10 V
0101	-10 ~ 10 V

5.3.3 Output Voltage/Current Ranges (Address 2)

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0000				0000			
Variable Name	-								DA1				DA0			

DAx (x: Output channel No.)

State	Description
0000	4 ~ 20 mA
0010	1 ~ 5 V
0011	0 ~ 5 V
0100	0 ~ 10 V
0101	-10 ~ 10 V

5.3.4 Analog I/O Data Ranges (Address 3)

(1) You can set the data ranges of the analog I/O for each channel.
(2) When no output data range is specified, all the channels are set as 0 ~ 8000.
(3) The data setting ranges are as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	00		00		00		00		00		00	
Variable Name	-				DA1		DA0		AD3		AD2		AD1		AD0	

ADx / DAx (x: I/O channel No.)

State	Description
00	0 ~ 8000
01	-4000 ~ 4000
10	Precise Value
11	0 ~ 10000

5.3.5 Average Process (Address 4)

(1) This is the area where you designate the method of average processing. Average processing divides into 'sampling,' 'count average,' 'time average' and 'weighted average.'
(2) When you designate no average processing, all the channels conduct sampling processing.
(3) The designation of average processing is as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	00		00		00		00	
Variable Name	-								AD3		AD2		AD1		AD0	

ADx (x: Input channel No.)

State	Description
00	Sampling
01	Time average
10	Count average
11	Weighted average

5.3.6 Average Value (Addresses 5 ~ 8)

(1) The setting ranges of the constant for the time/count/weighted averages are as follows.
  (a) Time average: 16 ~ 16000(ms)
  (b) Count average: 2 ~ 64000(times)
  (c) Weighted average: 1 ~ 99(%)

(2) If you designate a value beyond the range, the following error code is displayed in Address 13, (1) error number 17x for excessive time average setting, (2) error number 18x for excessive count average setting, or (3) error number 19x for excessive weighted average setting. At this time, the averaging is executed with the initial value. (In the error code, 'x' is the channel where the error occurred.)
(3) The setting of time/count/weighted averages values is as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0x0000															
Variable Name	ADCHx_AVG															

Where the average values of the input channel x is stored.

Averaging method	Setting range
Time average	4 ~ 16000 (ms)
Number average	2 ~ 64000 (times)
Weighted average	0 ~ 99 (%)

5.3.7 Analog output channel type setting (address 9)

(1) The output type of the analog output channel can be set up with former, minimum, medium, or maximum value.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0000				0000			
Variable Name	-								DA1				DA0			

DAx (x: Output channel No.)

State	Description
0000	Former value
0001	Minimum value
0010	Medium value
0011	Maximum value

5.3.8 Error Code (Address 13)

(1) This saves the error code detected by the analog I/O module.
(2) The types and descriptions of the errors are as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-								Error Code							

Type	Code	LED	Description
System error (1~99)	10	0.2s blink	ASIC RESET error
	11	0.2s blink	RAM error
	12	0.2s blink	RESISTER error
	13	0.2s blink	EEPROM CHECKSUM error
	20	0.2s blink	ADC failure
	21	0.2s blink	DAC failure
Input error (100~199)	17x	1s blink	Time average value exceeded
	18x	1s blink	Count average value exceeded
	19x	1s blink	Weighted average value exceeded
Output error (200~299)	27x	1s blink	Digital exceeded
Input offset gain error (300~399)	31x	1s blink	4~20mA offset/gain reverse error
	32x	1s blink	0~20V offset/gain reverse error (unused)
	33x	1s blink	1~5V offset/gain reverse error
	34x	1s blink	0~5V offset/gain reverse error
	35x	1s blink	0~10V offset/gain reverse error
	36x	1s blink	-10~10V offset/gain reverse error
Output offset gain error (400~499)	41x	1s blink	4~20mA offset/gain reverse error
	42x	1s blink	0~20V offset/gain reverse error (unused)
	43x	1s blink	1~5V offset/gain reverse error
	44x	1s blink	0~5V offset/gain reverse error
	45x	1s blink	0~10V offset/gain reverse error
	46x	1s blink	-10~10V offset/gain reverse error

※ 'x' of the error code means the channel where the error occurred.

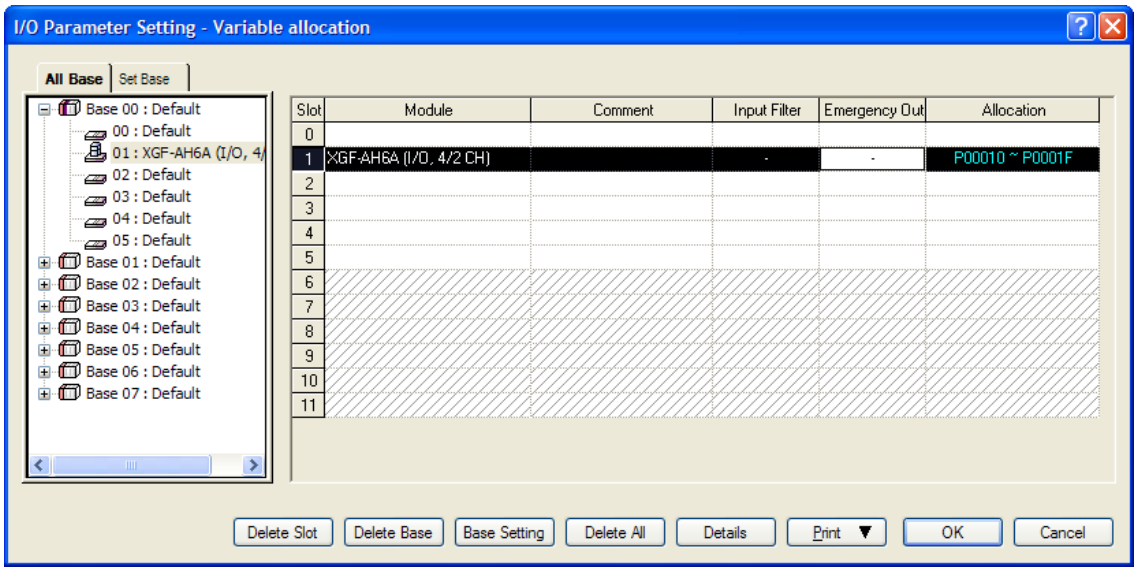
(3) If there are two or more errors, the module saves the error code of the lowest number and does not save the following error codes.
(4) If the error display does not disappear after the error has been corrected, you should use the error clear request flag (see 5.2.5) or turn the power supply Off → On after the error is corrected so that the LED stops flashing and the error code is deleted.

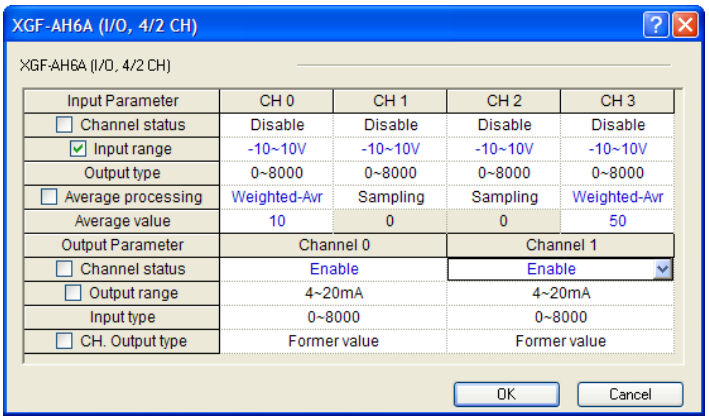
Chapter 6 Programming (XGK)

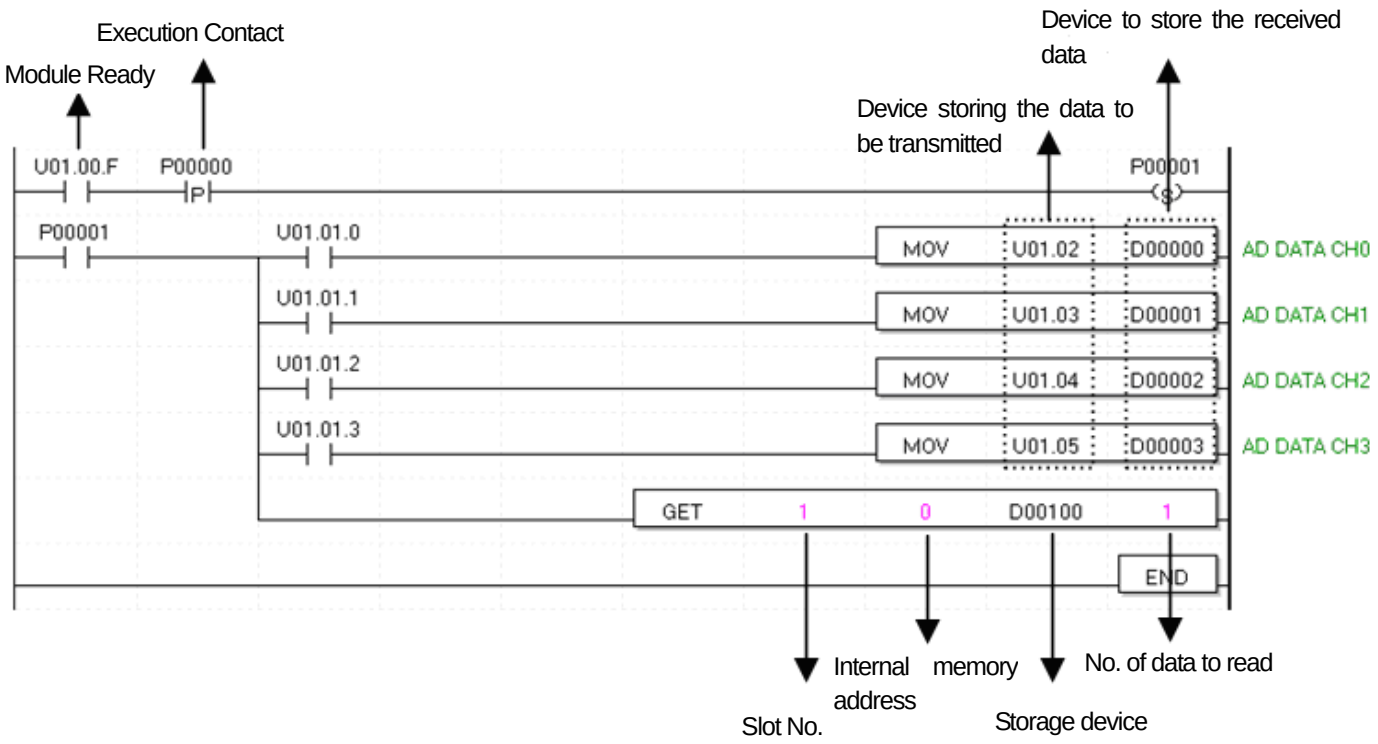
6.1 Basic Program

(1) This chapter provides information on how to set the operating conditions for the internal memory.
(2) The analog I/O module is assumed to be mounted in slot 1.
(3) The input and output occupancy point of the analog I/O module is 16 points (variable type) and 64 points (fixed type).
(4) The initial setting condition is one time entry. The setting of the initial value is saved in the internal memory of the analog I/O module.

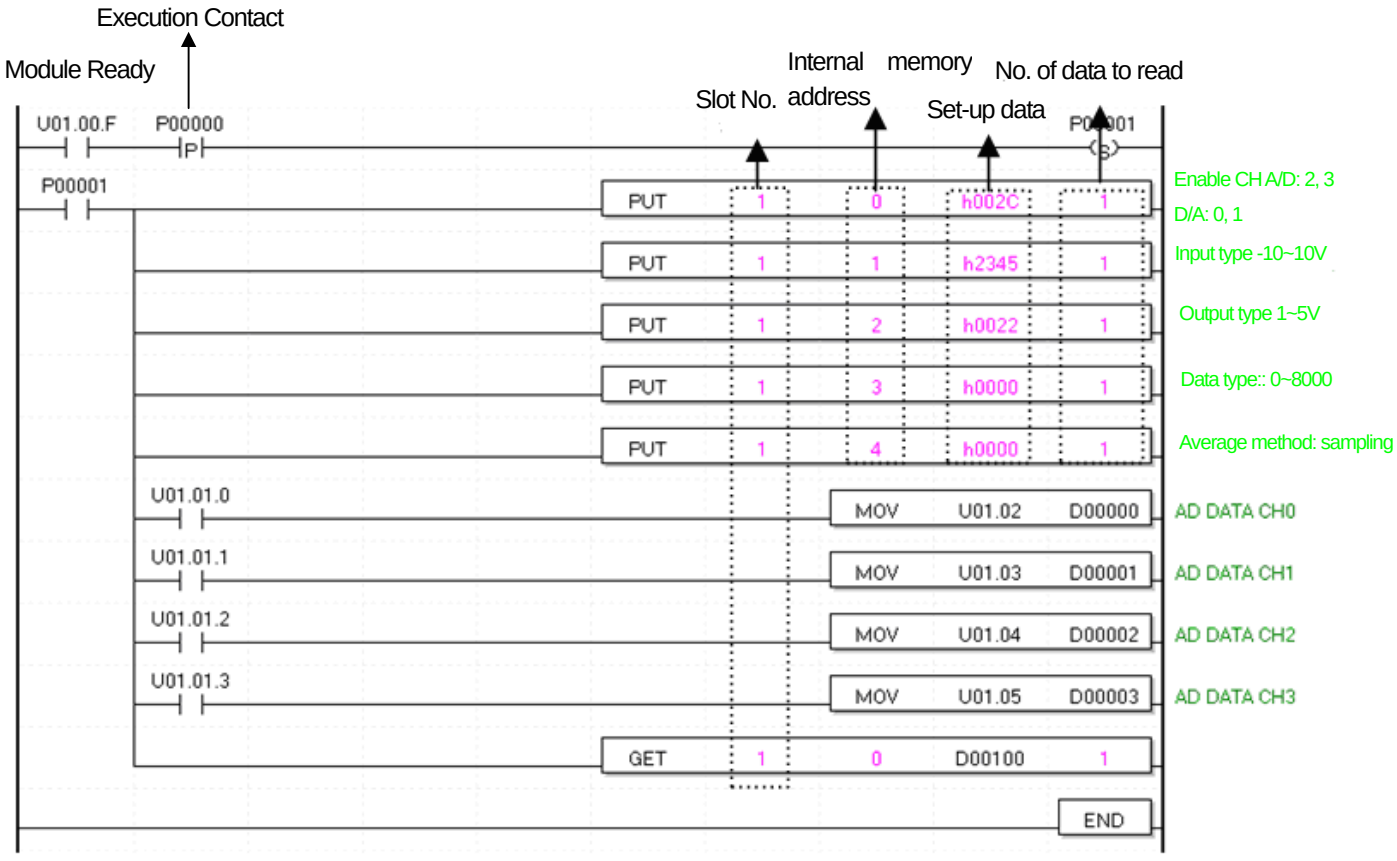
6.1.1 Example of Program That Uses [I/O Parameter]







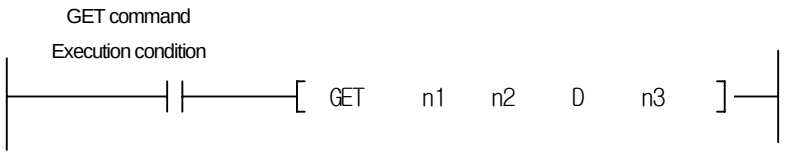
6.1.2 Example of Program That Uses the PUT/GET Command



6.2 Read/Write Operating Parameter Setting Area

6.2.1 Read Operating Parameter Setting Area (GET, GETP command)

Form



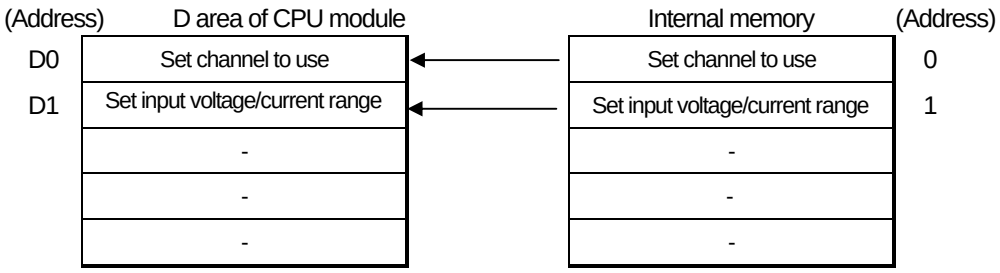
Form	Description	Usable Area
n1	No. of the slot mounted with special module	Constant
n2	Head address of the special module operating parameter setting area to read	Constant
D	Head address of the device storing the data to read	P, M, K, L, D, #U, R, N, ZR [Z]
n3	Number of the words of the data to read	P, M, K, L, D, #U, R, N, ZR, constant [Z]

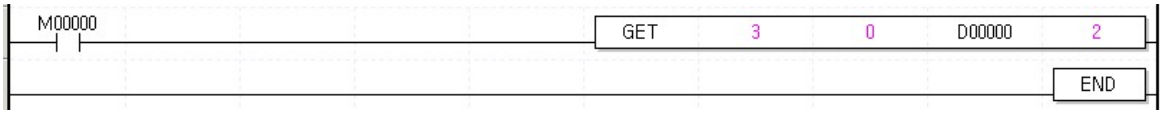
< Difference between the GET and GETP commands>

GET: run continuously with the execution condition On( )

GETP: run by triggering the execution condition( )

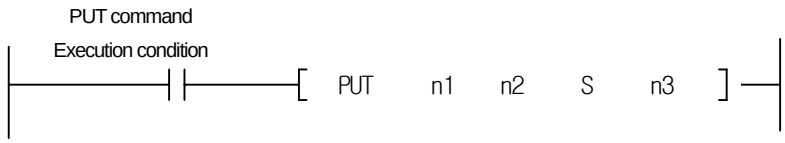
E.g. If the analog I/O module is at #3 slot, #0 base, and read the address 0, 1 of internal memory into the D0, D1 of the CPU module;





6.2.2 Write Operating Parameter Setting Area (PUT, PUTP command)

Form



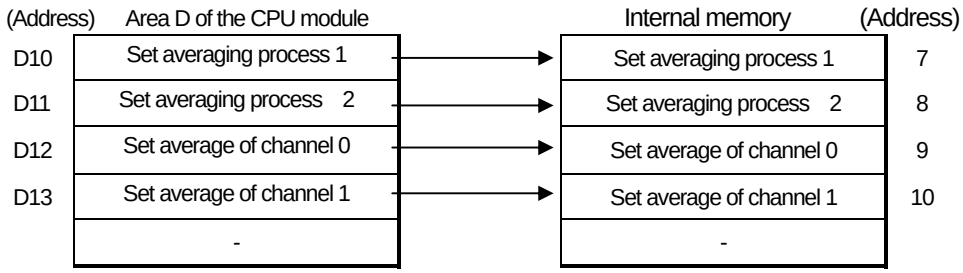
Form	Description	Usable Area
n1	No. of the slot mounted with special module	Constant
n2	Head address of the special module operating parameter setting area to read	Constant
D	Head address of the device storing the data to read	P, M, K, L, D, #U, R, N, ZR [Z]
n3	Number of the words of the data to read	Integer

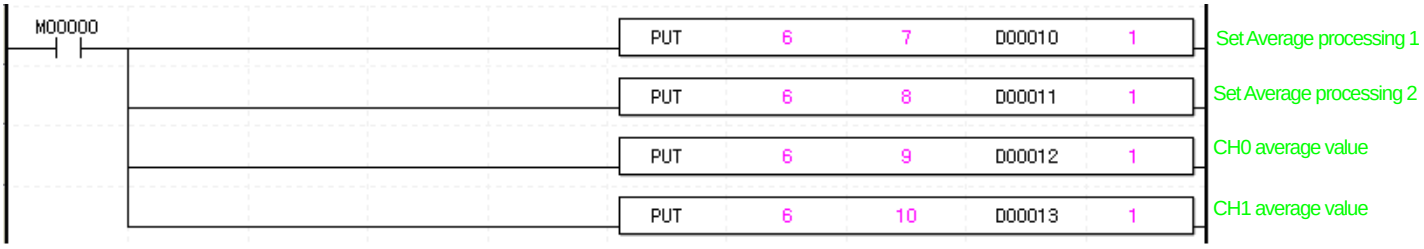
< Difference between the PUT and PUTP commands>

PUT: run continuously with the execution condition On ( )

PUTP: run by triggering the execution condition ( )

E.g. If the analog I/O module is at #6 slot, #0 base, and write the data in the address D10 ~ D13 of the CPU module into the addresses 7 ~ 10 of the internal memory of the module;





6.3 Application Program

6.3.1 Output twice as much as the analog input, sorting magnitude

(1) System configuration

(2) Initial setting

No.	Item	Initial parameter setting
1	Channel in use	Input CH0 Output CH0
2	I/O range	Input 0 : 0~5V Output 0 : 0~10V
3	I/O data type	Input 0 : 0~8000 Output 0 : 0~8000
4	Averaging process	N/A

(3) Program description

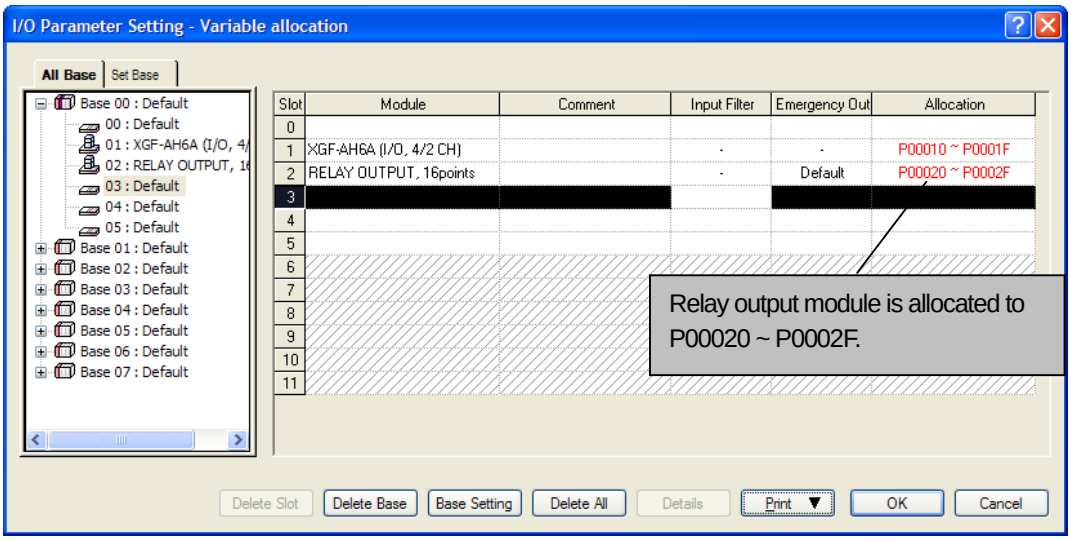
(a) When the analog input value of the channel 0 is smaller than 2.5V (4000), the contact No. 0 of the relay module at slot 2 is turned on.

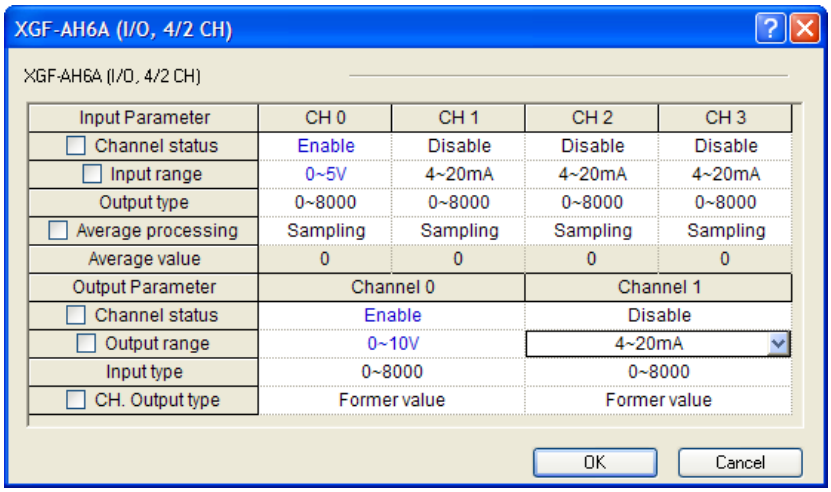
(b) When the analog input value of the channel 0 is larger than 2.5V (4000), the contact No. 2 of the relay module at slot 2 is turned on.

(c) The analog (0V ~ 5V) input of the input channel 0 is amplified by 2 times and outputted through output channel 0.

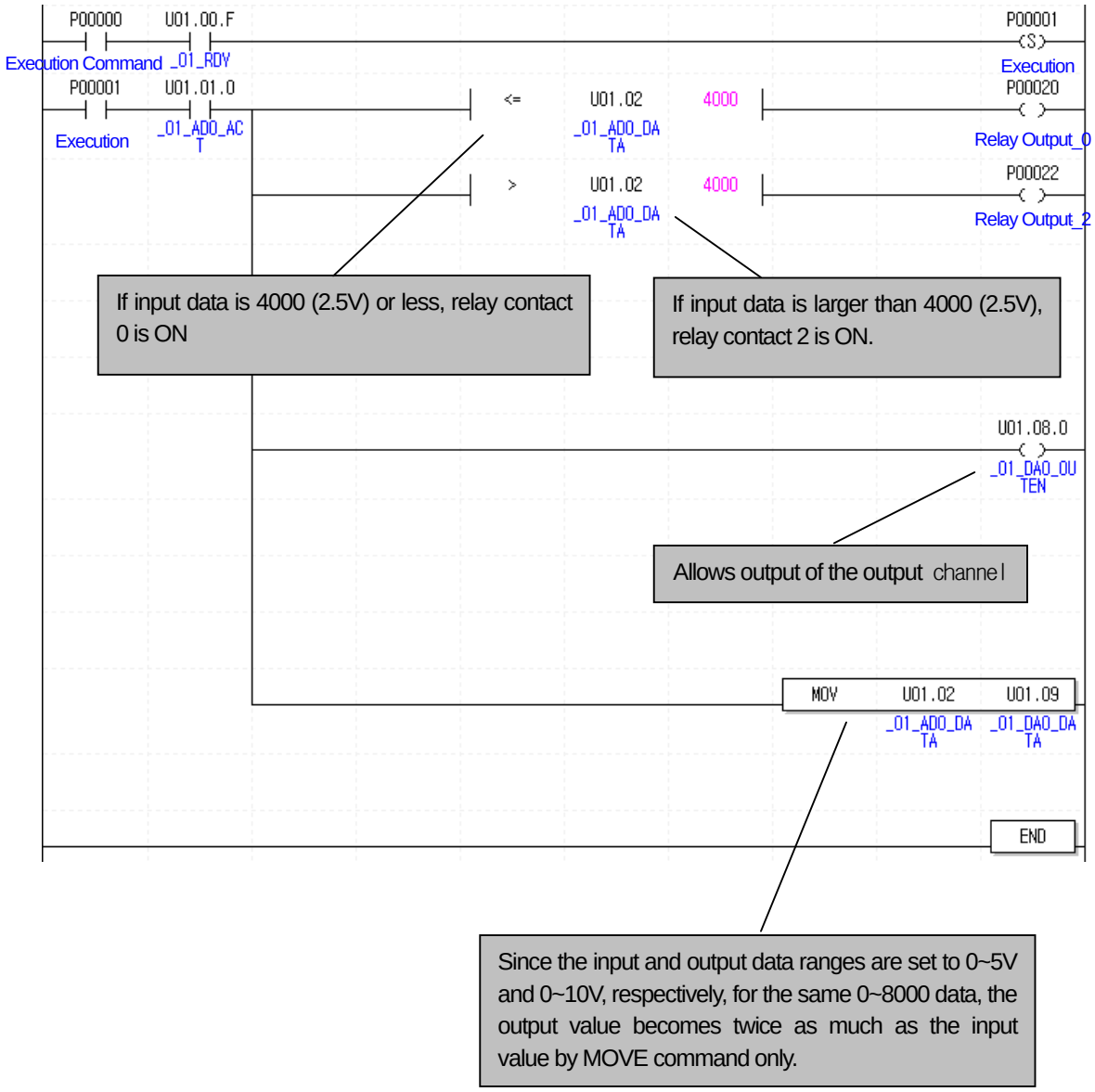
(4) Program

(a) [I/O Parameter] Setting





(b) Ladder programming



Chapter 7 Configuration and Functions of Global Variables (for XGI/XGR)

The analog I/O module has internal memory for data communication with PLC CPU.

7.1 Global Variables (Data Areas)

This section describes the configuration of the global variables.

7.1.1 Input and Output Memory Area

[Table 7.1] presents the I/O memory areas of the analog I/O module.

[Table 7.1] I/O memory areas

Memory Address	Global variables	Description
%UXxx.yy.15	_xxyy_RDY	Module ready (R)
%UXxx.yy.0	_xxyy_AD0_ERR	Input 0 channel error (R)
%UXxx.yy.1	_xxyy_AD1_ERR	Input 1 channel error (R)
%UXxx.yy.2	_xxyy_AD2_ERR	Input 2 channel error (R)
%UXxx.yy.3	_xxyy_AD3_ERR	Input 3 channel error (R)
%UXxx.yy.4	_xxyy_DA0_ERR	Output 0 channel error(R)
%UXxx.yy.5	_xxyy_DA1_ERR	Output 1 channel error(R)
%UXxx.yy.16	_xxyy_AD0_ACT	Input 0 channel active (R)
%UXxx.yy.17	_xxyy_AD1_ACT	Input 1 channel active (R)
%UXxx.yy.18	_xxyy_AD2_ACT	Input 2 channel active (R)
%UXxx.yy.19	_xxyy_AD3_ACT	Input 3 channel active (R)
%UXxx.yy.20	_xxyy_DA0_ACT	Output 0 channel active (R)
%UXxx.yy.21	_xxyy_DA1_ACT	Output 1 channel active (R)
%UWxx.yy.2	_xxyy_AD0_DATA	Input CH0 data (R)
%UWxx.yy.3	_xxyy_AD1_DATA	Input CH1 data (R)
%UWxx.yy.4	_xxyy_AD2_DATA	Input CH2 data (R)
%UWxx.yy.5	_xxyy_AD3_DATA	Input CH3 data (R)
%UXxx.yy.96	_xxyy_AD0_IDD	Input CH0 disconnection flag (R)
%UXxx.yy.97	_xxyy_AD1_IDD	Input CH1 disconnection flag (R)
%UXxx.yy.98	_xxyy_AD2_IDD	Input CH2 disconnection flag (R)
%UXxx.yy.99	_xxyy_AD3_IDD	Input CH3 disconnection flag (R)
%UXxx.yy.112	_xxyy_ERR_CLR	Error clear request (W)
%UXxx.yy.128	_xxyy_DA0_OUTEN	Output CH0 status setting (W)
%UXxx.yy.129	_xxyy_DA1_OUTEN	Output CH1 status setting (W)
%UWxx.yy.9	_xxyy_DA0_DATA	Output CH0 data (R)
%UWxx.yy.10	_xxyy_DA1_DATA	Output CH1 data (R)

* (R), (W) means Read, Write respectively.

(1) In the memory address, x and y stand for the base and slot numbers where the module is installed.

(2) To read the 'CH1 analog input value of the analog I/O module at the slot #4, base #0, use Global variable _0004_AD1_DATA.

7.1.2 Operating Parameter Setting Area

[Table 7.2] presents the operating parameter setting area of the analog I/O module.

[**Table 7.2**] Operating parameter setting range

Memory Address	Symbol	Description
0	_Fxxyy_CH_EN	Enable/Disable the channel for (W)
1	_Fxxyy_AD_RANGE	Set input current/voltage range (W)
2	_Fxxyy_DA_RANGE	Set output current/voltage range (W)
3	_Fxxyy_DATA_TYPE	Set I/O data type (W)
4	_Fxxyy_AVG_SEL	Set input averaging method (W)
5	_Fxxyy_AD0_AVG_VAL	Average value of input channel 0 (W)
6	_Fxxyy_AD1_AVG_VAL	Average value of input channel 1 (W)
7	_Fxxyy_AD2_AVG_VAL	Average value of input channel 2 (W)
8	_Fxxyy_AD3_AVG_VAL	Average value of input channel 3 (W)
9	_Fxxyy_IDLE_OUT	Set channel output status (W)
13	_Fxxyy_ERR_CODE	Error code (R)

7.2 Data I/O Area

7.2.1 Module READY/ERROR Flag (%UXxx.yy.0 ~ %UXxx.yy.15)

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	RDY	-									DA1	DA0	AD3	AD2	AD1	AD0

RDY

State	Description
0	Module stop
1	Module run

ADx / DAx (x: Input/Output channel No.)

State	Description
0	Normal
1	The channel is in error

7.2.2 Operating channel flag (%UXxx.yy.16 ~ %UXxx.yy.21)

This is the area where the operating information for each I/O channel is stored.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-										DA1	DA0	AD3	AD2	AD1	AD0

ADx / DAx (x: Input/Output channel No.)

State	Description
0	Channel stop
1	Channel run

7.2.3 Digital output value (%UWxx.yy.2 ~ %UWxx.yy.5)

(1) The A/D converted digital output value is saved for each channel in the buffer memory address 2 ~ 5 (%UWxx.yy.2 ~ %UWxx.yy.5).

(2) The digital output values are saved in binary numbers of 16 bit.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0x0000															
Variable Name	ADx_DATA															

Where the converted data of the Input channel x is saved.

7.2.4 Disconnection detection flag (%UXxx.yy.96 ~ %UXxx.yy.99)

(1) The disconnection detection signal of each input channel is stored in %UXxx.yy.96 ~ %UXxx.yy.99.

(2) Each bit is set as 1 when a disconnection is detected for the allocated channel, and turns into 0 when the disconnection is recovered. Each bit can be used for disconnection detection in the user program as the operating conditions.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-												AD3	AD2	AD1	AD0

ADx (x: input channel No.)

State	Description
0	Normal
1	Disconnected

7.2.5 Error clear request flag (%UXxx.yy.112)

(1) When there is a parameter setting error, the error code of address 13 may not be automatically deleted even if you change the parameter to a correct value. If you turn on the error clear request bit, the error code of the address 13 and the error displayed in the [System monitoring] of XG5000 is deleted. RUN LED also turns to On from flashing.

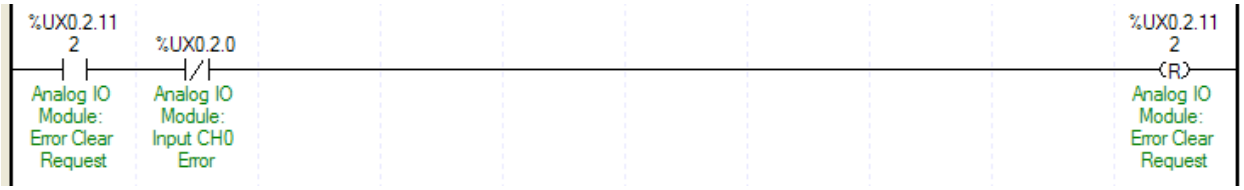
(2) You have to use the error clear request flag along with %UXxx.yy.0 ~ %UXxx.yy.5 (error flag) for normal operating as shown in [Fig. 7.1]

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-															ECLR_REQ

⇩

Error clear request flag (UXxx.yy.112)

Bit ON (1): error clear request, Bit Off (0): error clear stand-by



[Fig. 7. 1] How to use the error clear request flag

7.2.6 Allow analog output (%UXxx.yy.128 ~ %UXxx.yy.129)

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-														DA1	DA0

DAx (x: output channel No.)

State	Description
0	Prohibit channel output
1	Allow channel output

7.2.7 Analog output value (%UWxx.yy.9 ~ %UWxx.yy.10)

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0x0000															
Variable Name	DAx_DATA															

Where the user sets the conversion data of the output channel x

7.3 Operating Parameter Setting Area

▶ Each address of the internal memory occupies 1 word, which can be expressed in 16 bit.

7.3.1 Designation of the channel to use (address 0)

(1) You can set whether to enable/disable A/D conversion for each channel.
(2) You can shorten the conversion cycle for channels by blocking conversion of the channel you don't use.
(3) When no channel is designated for use, all the channels are set as not used.
(4) Enable/Disable of analog I/O conversion is as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-										DA1	DA0	AD3	AD2	AD1	AD0

ADx / DAx (x: Input/Output channel No.)

State	Description
0	Stop
1	Run

7.3.2 Input Voltage/Current Range (Address 1)

(1) You can set the ranges of the analog I/O input voltage/current for each channel.
(2) When no analog input range is specified, all the channels are set as 4 ~ 20 mA.
(3) The ranges of analog input voltage/current settings are as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0000				0000				0000				0000			
Variable Name	AD3				AD2				AD1				AD0			

ADx (x: input channel No.)

State	Description
0000	4 ~ 20 ㎃
0010	1 ~ 5 V
0011	0 ~ 5 V
0100	0 ~ 10 V
0101	-10 ~ 10 V

7.3.3 Output Voltage/Current Ranges (Address 2)

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0000				0000			
Variable Name	-								DA1				DA0			

DAx (x: output channel No.)

State	Description
0000	4 ~ 20 mA
0010	1 ~ 5 V
0011	0 ~ 5 V
0100	0 ~ 10 V
0101	-10 ~ 10 V

7.3.4 Analog I/O Data Ranges (Address 3)

(1) You can set the data ranges of the analog I/O for each channel.
(2) When no output data range is specified, all the channels are set as 0 ~ 8000.
(3) The data setting ranges are as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	00		00		00		00		00		00	
Variable Name	-				DA1		DA0		AD3		AD2		AD1		AD0	

ADx / DAx (x: Input/Output channel No.)

State	Description
00	0 ~ 8000
01	-4000 ~ 4000
10	4000~20000
11	0 ~ 10000(%)

7.3.5 Average Processing (Address 4)

(1) This is the area where you designate the method of average processing. Average processing divides into 'sampling,' 'count average,' 'time average' and 'weighted average.'
(2) When you designate no average processing, all the channels conduct sampling processing.
(3) The designation of average processing is as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	00		00		00		00	
Variable Name	-								AD3		AD2		AD1		AD0	

ADx (x: input channel No.)

State	Description
00	Sampling
01	Time average
10	Count average
11	Weighted average

7.3.6 Average Value (Addresses 5 ~ 8)

(1) The setting ranges of the constant for the time/count/weighted averages are as follows.
  (a) Time average: 16 ~ 16000(ms)
  (b) Count average: 2 ~ 64000(times)
  (c) Weighted average: 1 ~ 99(%)

(2) If you designate a value beyond the range, the following error codes are displayed in address 13, (1) error number 17x for excessive time average setting, (2) error number 18x for excessive number average setting, or (3) error number 19x for excessive weighted average setting. At this time, the averaging is executed with the initial value. (In the error code, 'x' is the channel where the error occurred.)
(3) The setting of time/count/weighted averages processing values is as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0x0000															
Variable Name	ADCHx_AVG															

Where the average setting values of the input channel x is stored.

Averaging method	Setting range
Time average	4 ~ 16000 (ms)
Count average	2 ~ 64000 (times)
Weighted average	0 ~ 99 (%)

7.3.7 Analog output channel type setting (address 9)

(1) The output type of the analog output channel can be set up with former, minimum, medium, or maximum value.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0000				0000			
Variable Name	-								DA1				DA0			

DAx (x: output channel No.)

State	Description
0000	Former value
0001	Minimum value
0010	Medium value
0011	Maximum value

7.3.8 Error Code (Address 13)

(1) This saves the error code detected by the analog I/O module.
(2) The types and descriptions of the errors are as follows.

State	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable Name	-								Error Code							

Type	Code	LED	Description
System error (1~99)	10	0.2s blink	ASIC RESET error
	11	0.2s blink	RAM error
	12	0.2s blink	RESISTER error
	13	0.2s blink	EEPROM CHECKSUM error
	20	0.2s blink	ADC failure
	21	0.2s blink	DAC failure
Input error (100~199)	17x	1s blink	Time average setting range excess error
	18x	1s blink	Number average setting range excess error
	19x	1s blink	Weighted average setting range excess error
Output error (200~299)	27x	1s blink	Digital data range excess error
Input offset gain error (300~399)	31x	1s blink	4~20mA offset/gain reverse error
	32x	1s blink	0~20V offset/gain reverse error (unused)
	33x	1s blink	1~5V offset/gain reverse error
	34x	1s blink	0~5V offset/gain reverse error
	35x	1s blink	0~10V offset/gain reverse error
	36x	1s blink	-10~10V offset/gain reverse error
Output offset gain error (400~499)	41x	1s blink	4~20mA offset/gain reverse error
	42x	1s blink	0~20V offset/gain reverse error (unused)
	43x	1s blink	1~5V offset/gain reverse error
	44x	1s blink	0~5V offset/gain reverse error
	45x	1s blink	0~10V offset/gain reverse error
	46x	1s blink	-10~10V offset/gain reverse error

※ 'x' of the error code means the channel where the error occurred.

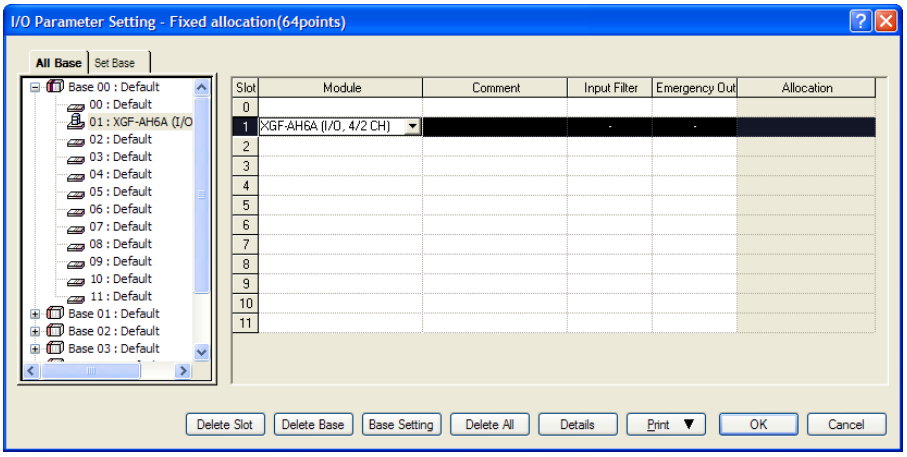
(3) If there are two or more errors, the module saves the error code of the lowest number and does not save the following error codes.
(4) If the error display does not disappear after the error has been corrected, you should use the error clear request flag (see 7.2.5) or turn the power supply Off → On after the error is corrected so that the LED stops flashing and the error code is deleted.

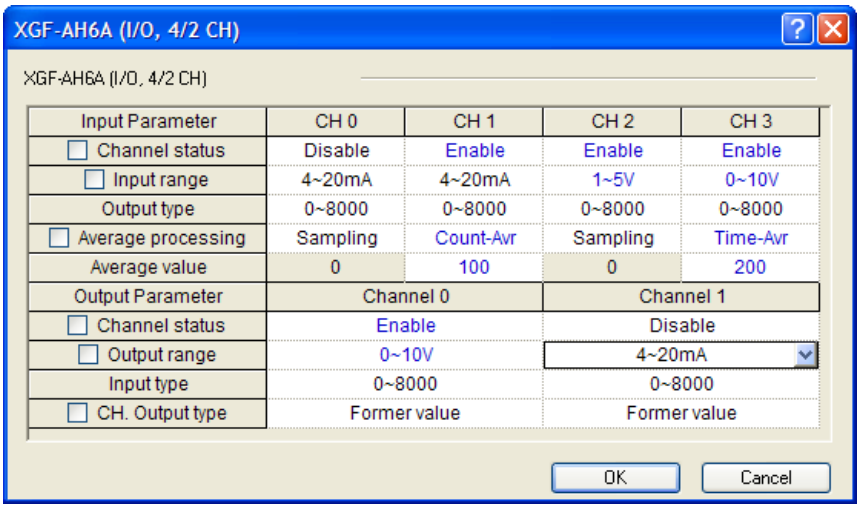
Chapter 8 Programming (XGI, XGR)

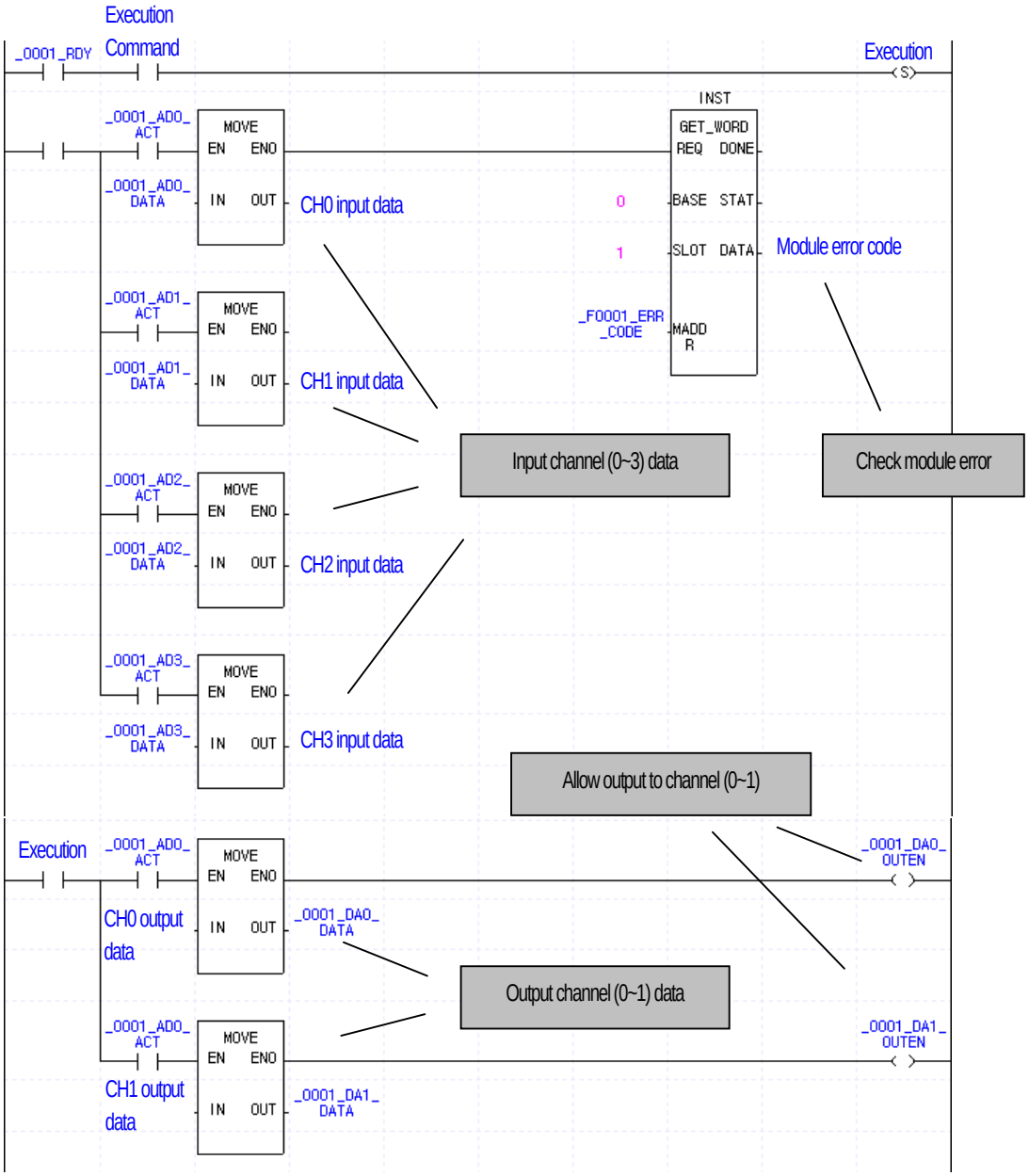
8.1 Basic Program

- This chapter provides information on how to set the operating conditions for the internal memory of the analog I/O module.
- The analog I/O module is mounted in slot 2.
- The input and output occupancy point of the analog I/O module is 16 points (variable).
- The initial setting condition is one time entry. The setting of the initial value is saved in the internal memory of the module.

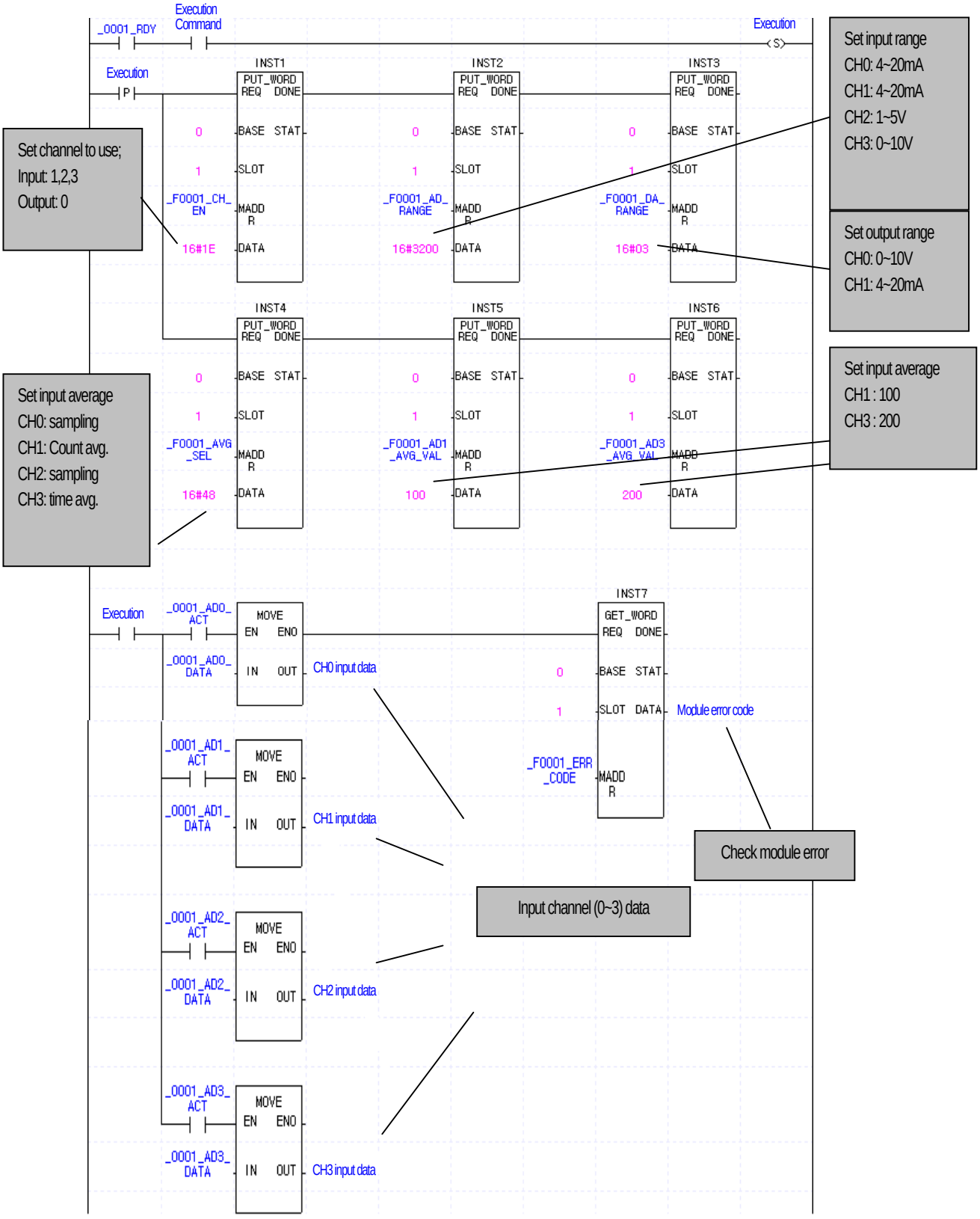
8.1.1 Example of Program That Uses [I/O Parameter]

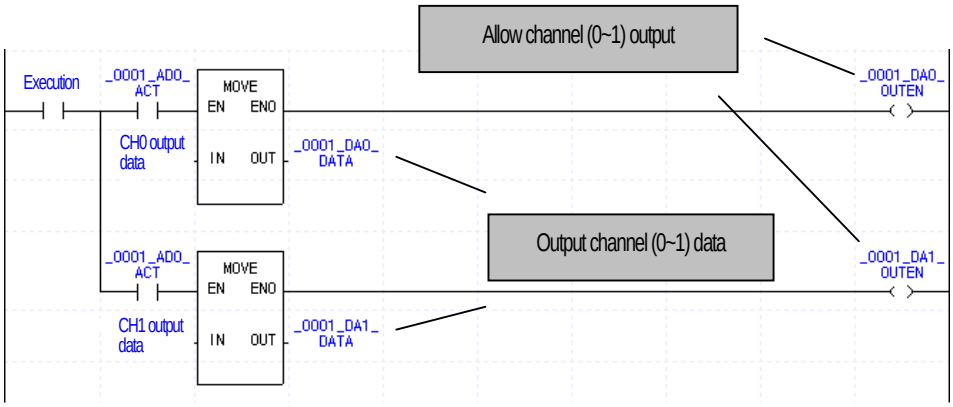





Execution
Command
_0001_RDY
Execution
(S)
INST
GET_WORD
REQ DONE
BASE STAT
SLOT DATA
MADD R
0
1
_F0001_ERR_CODE
Module error code
_0001_AD0_ACT
_0001_AD0_DATA
MOVE
EN ENO
IN OUT
CH0 input data
_0001_AD1_ACT
_0001_AD1_DATA
CH1 input data
_0001_AD2_ACT
_0001_AD2_DATA
CH2 input data
_0001_AD3_ACT
_0001_AD3_DATA
CH3 input data
Input channel (0~3) data
Check module error
Allow output to channel (0~1)
Execution
CH0 output data
CH1 output data
_0001_DA0_DATA
_0001_DA1_DATA
Output channel (0~1) data
_0001_DA0_OUTEN
_0001_DA1_OUTEN

8.1.2 Example of Program Using the PUT/GET Command




Allow channel (0~1) output
Execution
_0001_AD0_ACT
MOVE
EN
ENO
CH0 output data
IN
OUT
_0001_DA0_DATA
_0001_DA0_OUTEN
Output channel (0~1) data
_0001_AD0_ACT
MOVE
EN
ENO
CH1 output data
IN
OUT
_0001_DA1_DATA
_0001_DA1_OUTEN

8.2 Application Program

8.2.1 Output twice as much as the analog input, sorting magnitude

(1) System configuration

(2) Initial setting

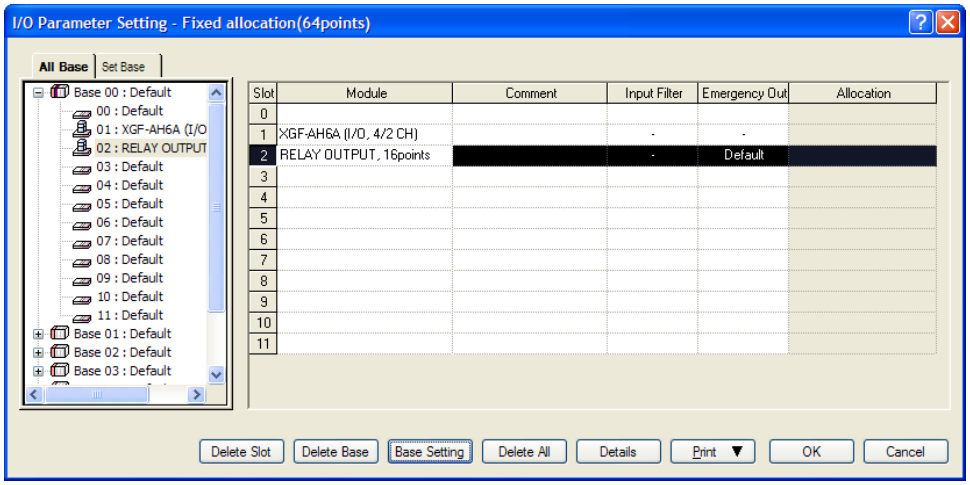
No.	Item	Initial setting	Memory Address	Memory Value
1	Channel in use	input CH0 output CH0	0	16#0011
2	I/O range	Input 0 : 0~5V Output 0 : 0~10V	1 2	16#0003 16#0004
3	I/O data type	Input 0: 0~8000 Output 0: 0~8000	3	16#0000
4	Average processing	N/A	4	16#0000

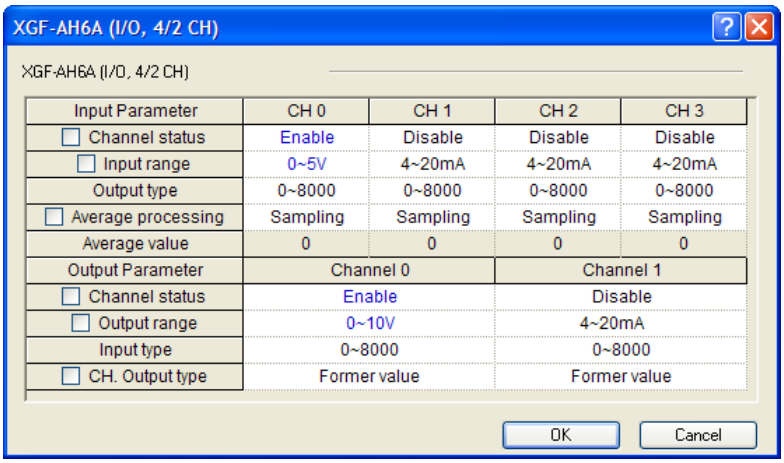
(3) Program description

(a) The analog (0V ~ 5V) input of the channel 0 is amplified by 2 times and outputted to output channel 0.
(b) If the analog input of the input channel 0 is 2.5V (4000) or less, the #0 contact (%QX0.2.0) of the relay module at slot 2 is turned on.
(c) If the analog input of the input channel 0 is above 2.5V (4000), the #2 contact (%QX0.2.2) of the relay module at slot 2 is turned on.

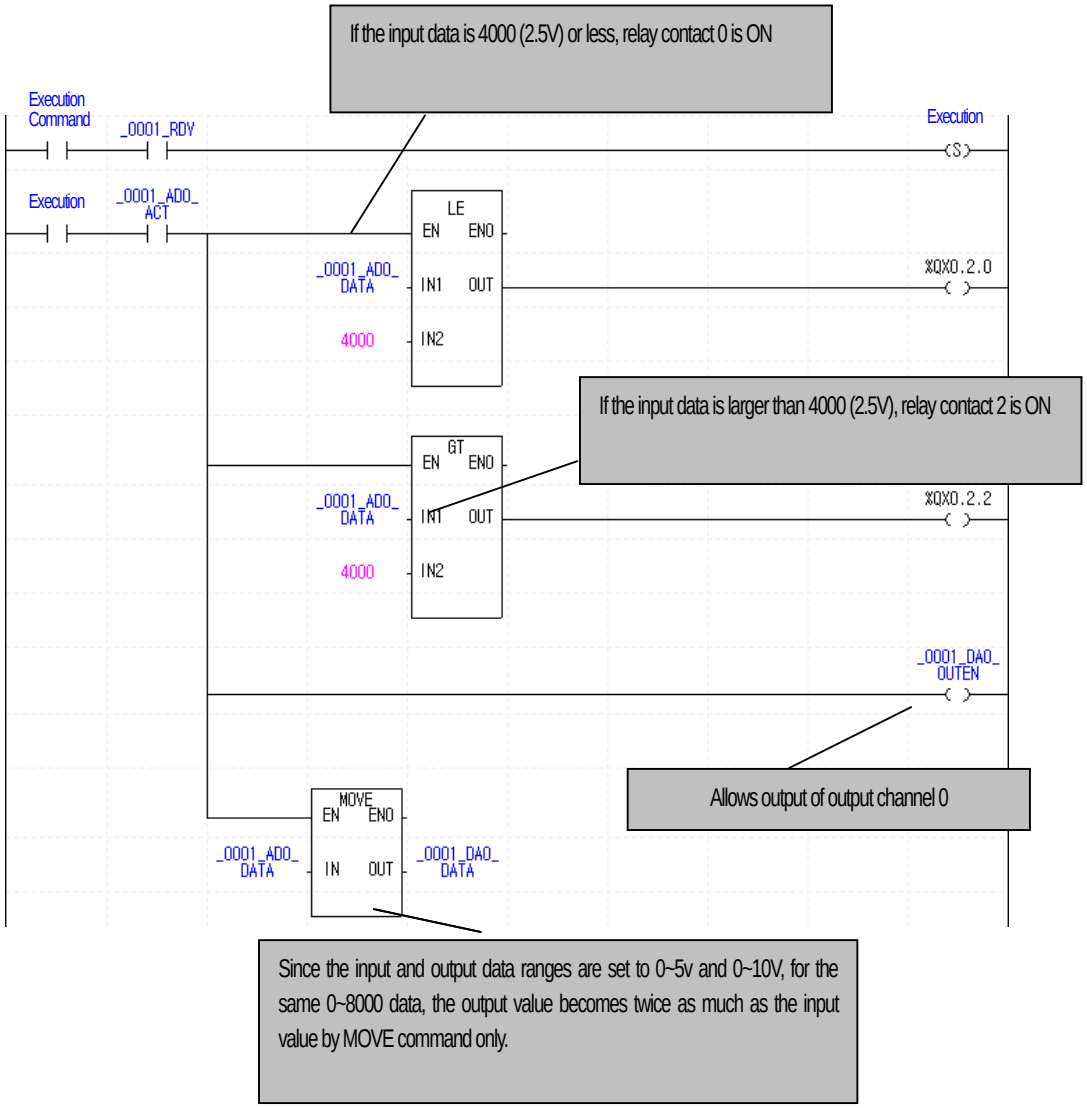
(4) Program

(a) [I/O Parameter] Setting





(b) Ladder Programming



Chapter 9 Failure Check

This chapter provides information on the errors and failure check of the analog I/O module.

9.1 Error Code

The errors of the analog I/O module can be identified by the blink of the RUN LED and the error code described in the 9.2.6. [Table 9.1] below presents the error code list.

[Table 9. 1] Error code list

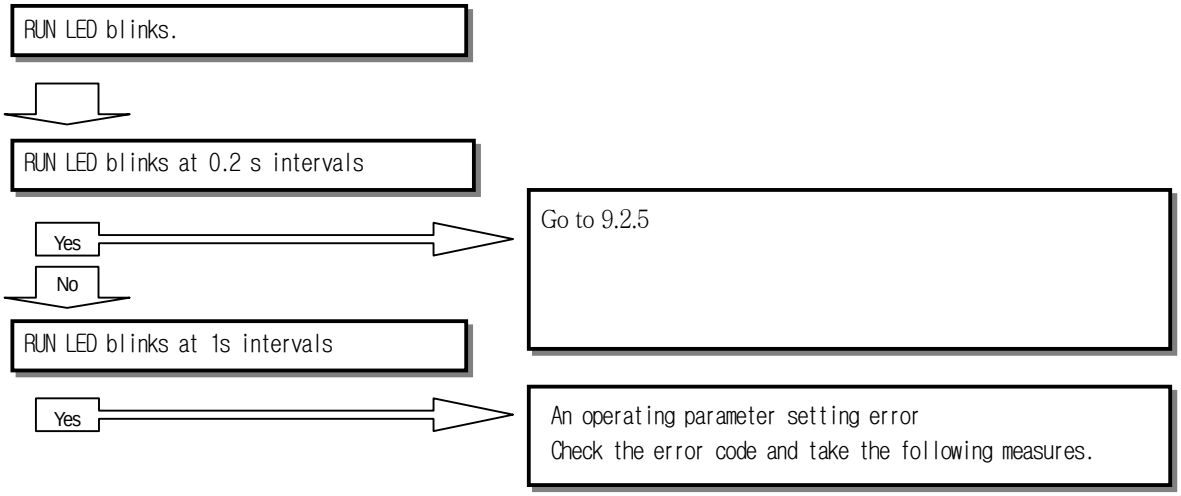
Classification	Code	LED	Description
System error (1~99)	10	0.2s blink	ASIC RESET error
	11	0.2s blink	RAM error
	12	0.2s blink	RESISTER error
	13	0.2s blink	EEPROM CHECKSUM error
	20	0.2s blink	ADC failure
	21	0.2s blink	DAC failure
Input error (100~199)	17x	1s blink	Time average setting range excess error
	18x	1s blink	Number average setting range excess error
	19x	1s blink	Weighted average setting range excess error
Output error (200~299)	27x	1s blink	Digital data range excess error
Input offset gain error (300~399)	31x	1s blink	4~20mA offset/gain reverse error
	33x	1s blink	1~5V offset/gain reverse error
	34x	1s blink	0~5V offset/gain reverse error
	35x	1s blink	0~10V offset/gain reverse error
	36x	1s blink	-10~10V offset/gain reverse error
Output offset gain error (400~499)	41x	1s blink	4~20mA offset/gain reverse error
	43x	1s blink	1~5V offset/gain reverse error
	44x	1s blink	0~5V offset/gain reverse error
	45x	1s blink	0~10V offset/gain reverse error
	46x	1s blink	-10~10V offset/gain reverse error

Note

(1) 'x' of the error code means the channel where the error occurred.
(2) If there are two or more errors, the module saves the error code that happened first and does not save the following error codes.
(3) If you use an error clear request flag, you can delete the error code in the sequence program (see 5.2.5).

9.2 Failure Check

9.2.1 RUN LED blinks.

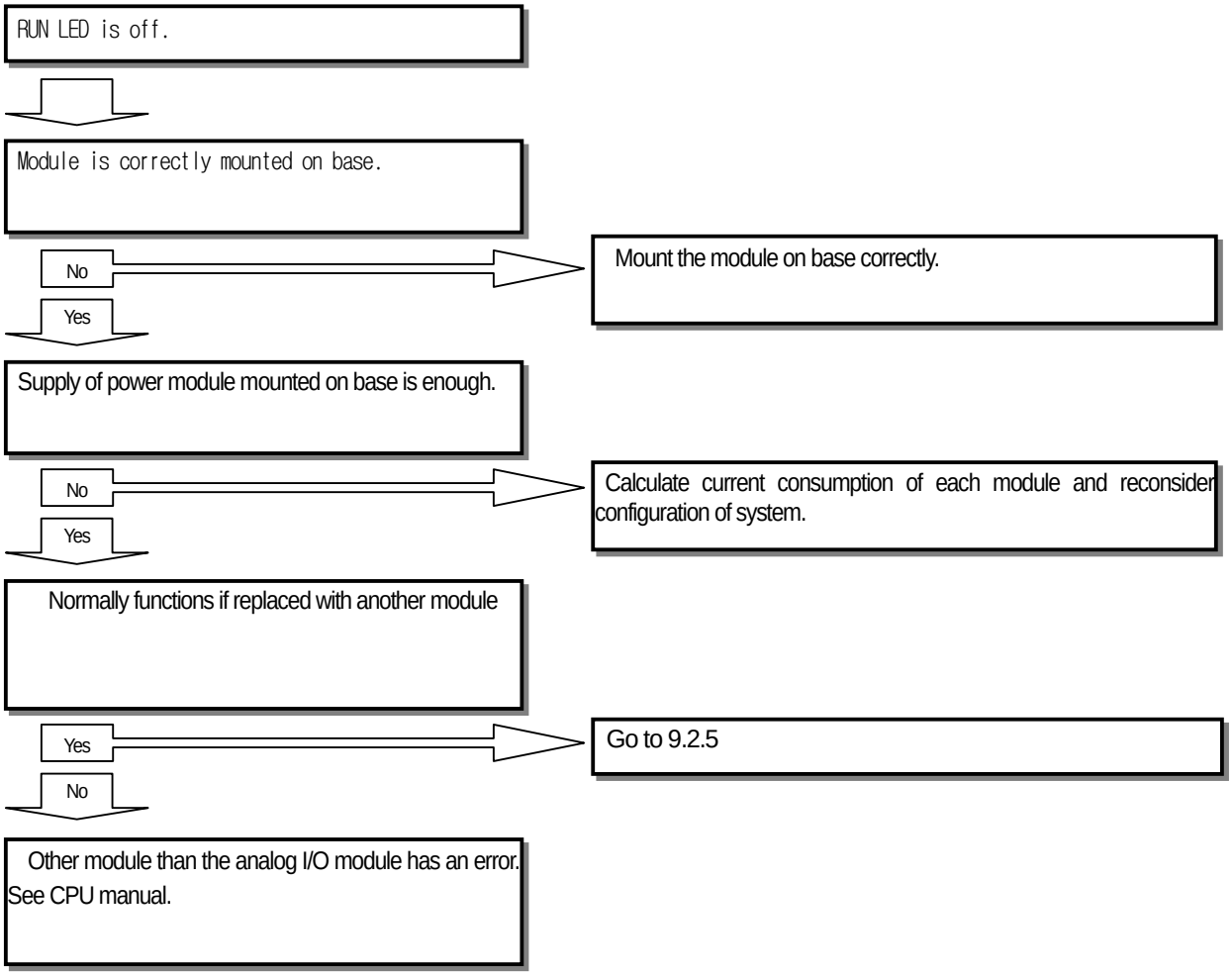

RUN LED blinks.
RUN LED blinks at 0.2 s intervals
Yes
Go to 9.2.5
No
RUN LED blinks at 1s intervals
Yes
An operating parameter setting error
Check the error code and take the following measures.

[Fig. 9. 2] RUN LED

[Table 9. 2] RUN LED

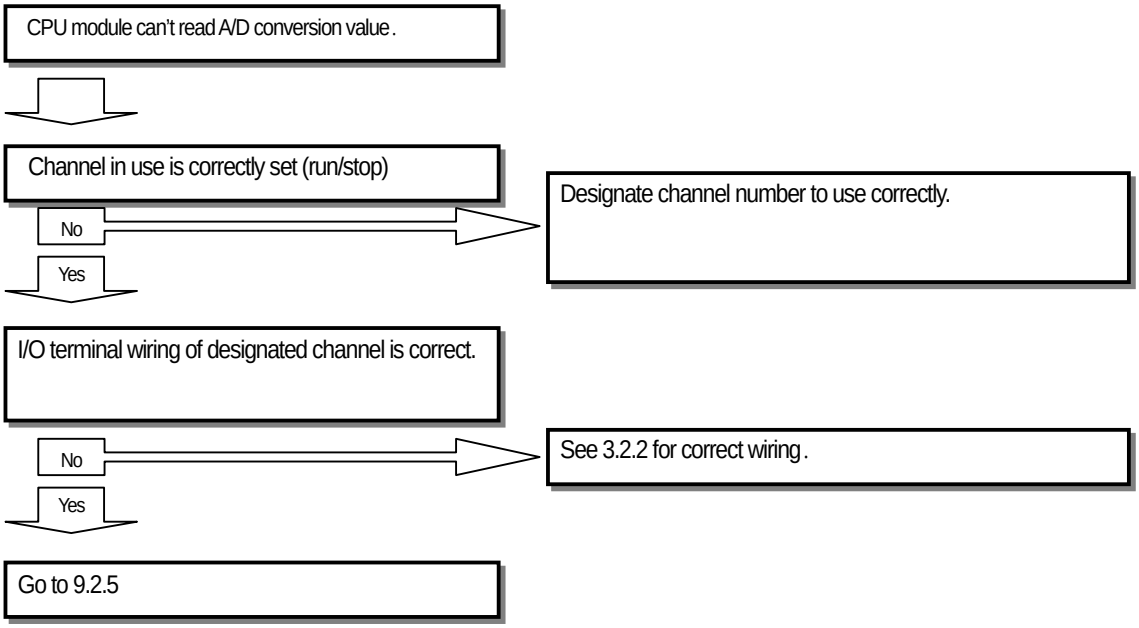
Code	LED	Description of the error	Action
17x	1s blink	Time average setting range excess error	Time average setting must be 16 ~ 16000
18x	1s blink	Number average setting range excess error	Number average setting must be 2 ~ 64000
19x	1s blink	Weighted average setting range excess error	Weighted average setting must be 1 ~ 99
27x	1s blink	Digital data range excess error	See 9.2.5
31x	1s blink	4~20mA offset/gain reverse error	
33x	1s blink	1~5V offset/gain reverse error	
34x	1s blink	0~5V offset/gain reverse error	
35x	1s blink	0~10V offset/gain reverse error	
36x	1s blink	-10~10V offset/gain reverse error	
41x	1s blink	4~20mA offset/gain reverse error	
43x	1s blink	1~5V offset/gain reverse error	
44x	1s blink	0~5V offset/gain reverse error	
45x	1s blink	0~10V offset/gain reverse error	
46x	1s blink	-10~10V offset/gain reverse error	

9.2.2 RUN LED Is Off.


RUN LED is off.
Module is correctly mounted on base.
No
Mount the module on base correctly.
Yes
Supply of power module mounted on base is enough.
No
Calculate current consumption of each module and reconsider configuration of system.
Yes
Normally functions if replaced with another module
Yes
Go to 9.2.5
No
Other module than the analog I/O module has an error.
See CPU manual.

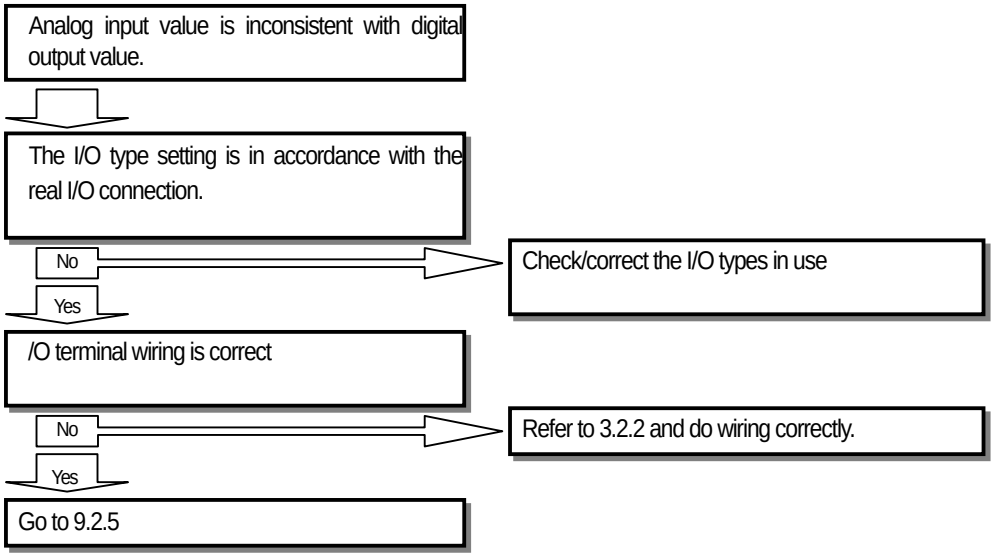
[Fig. 9. 2] RUN LED is off

9.2.3 CPU Module Cannot Read A/D Conversion Value.


CPU module can't read A/D conversion value.
Channel in use is correctly set (run/stop)
No
Designate channel number to use correctly.
Yes
I/O terminal wiring of designated channel is correct.
No
See 3.2.2 for correct wiring.
Yes
Go to 9.2.5

[Fig. 9. 3] Conversion value read error

9.2.4 The Analog Input Value is Inconsistent with Digital Output Value.


Analog input value is inconsistent with digital output value.
The I/O type setting is in accordance with the real I/O connection.
No
Check/correct the I/O types in use
Yes
/O terminal wiring is correct
No
Refer to 3.2.2 and do wiring correctly.
Yes
Go to 9.2.5

[Fig. 9. 4] Analog value inconsistent with digital data

9.2.5 Hardware Failure of the Analog I/O Module

Switch on/off the power. If it occurs again, a module failure is suspected. Contact us or a dealer.

[Fig. 9. 5] Hardware failure

9.2.6 Checking Analog I/O Module Status by XG5000 System MonitorXG5000

You can check the information of the analog I/O module using system monitor of XG5000. XG5000.

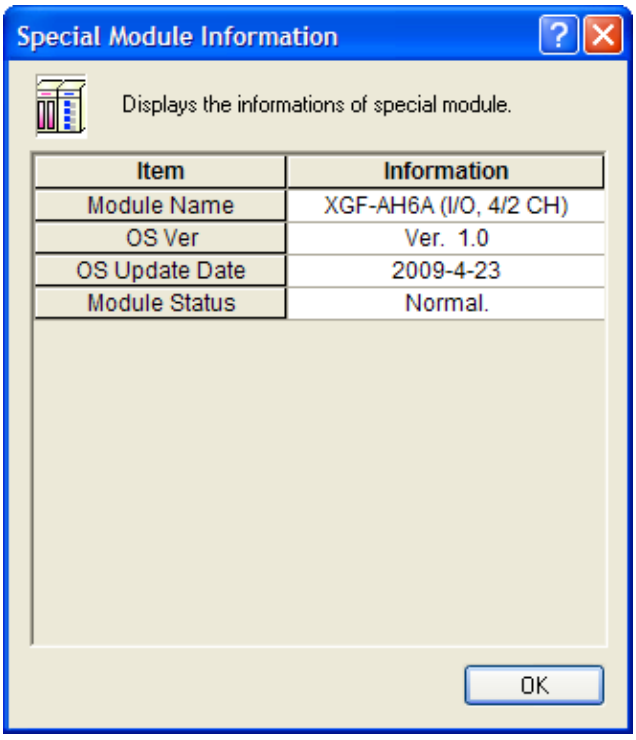
(1) Sequence

You can do the job either ways;

(a) [Monitor] -> [System monitoring] -> press right button of mouse on module figure -> [Special module info.]
(b) [Monitor] -> [System monitoring] -> double-click on module figure

(2) Module information

(a) Module name: displays the name of the currently mounted module.
(b) OS version: displays OS version of the mixed analog I/O.
(c) OS update date: shows the date of the OS.
(d) Module status: displays the current error code (for details, see Table 9.1).



[Fig. 9. 6] Special module information

Appendix 1 Glossary

The following glossary covers the manual and the entire analog module.

■ A/D converter: converts the analog input signals into digital values in proportion to the magnitude of the signals..

■ Analog input module: The module that has a circuit which converts analog voltage/current input signals into digital values. It has 14 otr16 bit resolutions according to the converter.

■ Channel: Related to the terminals of the analog input/output module, each channel is linked to various current/voltage input and output devices and has the data and check functions.

■ Conversion time: The time it takes for the analog input module to sample and convert the analog signals and then for the processor in the module to receive the converted digital values. In addition, this is the time for the digital values from the processor in the module to be converted into analog output signals and transmitted to the output channel.

■ D/A converter: Performs the function of producing analog voltage and current signals of continuous size in proportion to the digital value.

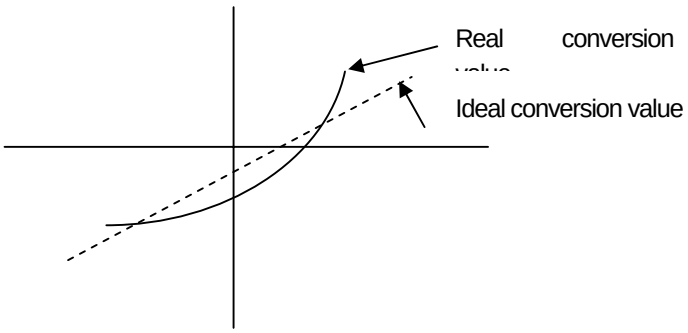
■ Full scale: The magnitude of voltage and current at which normal function is performed.

■ Full scale error: The difference between an ideal analog conversion value and real analog conversion value on the graph.

■ Full scale range: The difference between the maximum and minimum of the analog inputs

■ LSB(Least Significant Bit): the minimum value in the unit bit string.

■ Linearity error: The analog inputs and outputs being related to continuous voltage/current and digital values, ideal inputs and outputs are defines as a straight line within minimum 1LSB of voltage/current. The difference between an ideal analog conversion value and real analog conversion value on the graph is referred to as a linearity error in I/O.



■ Multiplexer: The switching circuit where multiple circuits share a single A/D converter or D/A converter.

■ Analog output module: The module that has an output module which converts the analog DC voltage or current signals in proportion to the digital values transmitted from the processor to the module.

■ Resolution: The minimum value that can be recognized in the measure. It is expressed in engineering units (1mV or number of Bits) in general. That is, 14 Bit is capable of 16383 types of outputs.

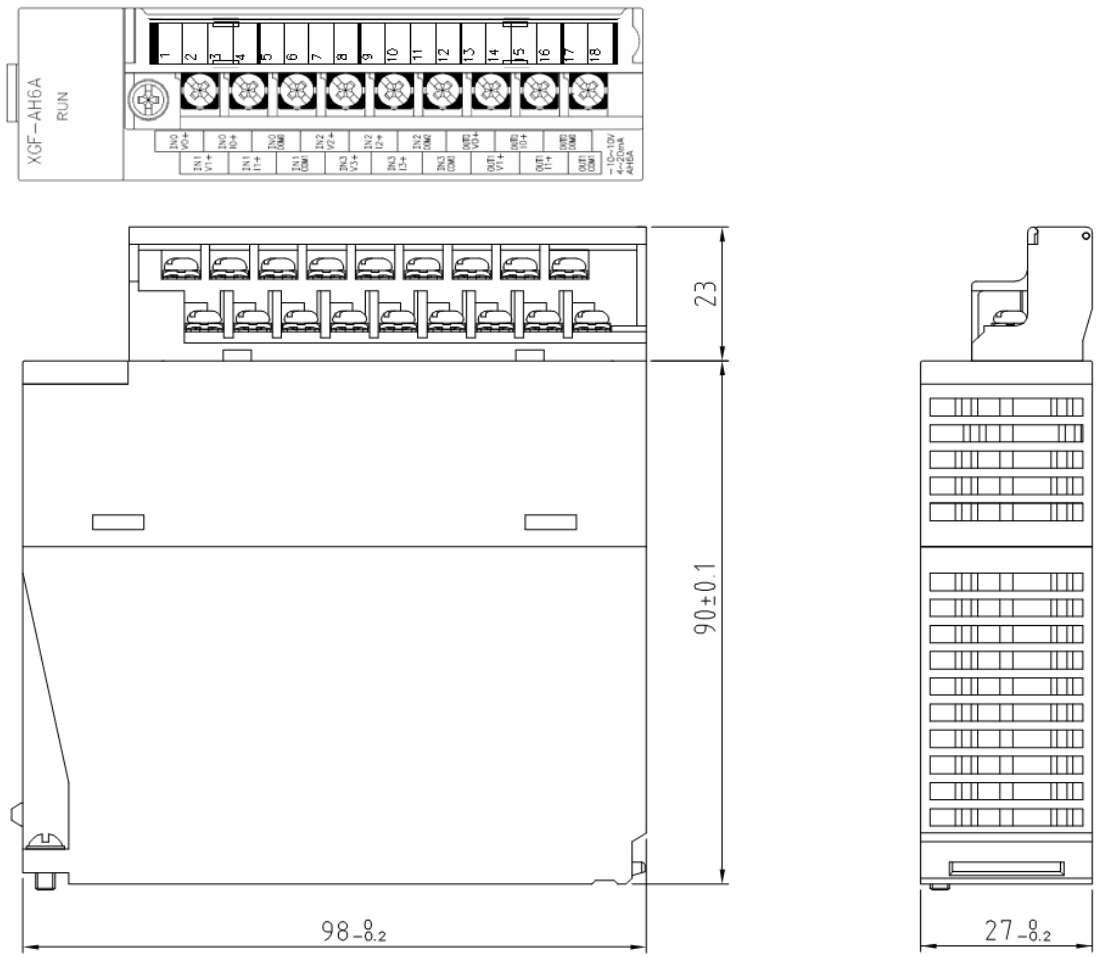
■ Filter: The device that softens the change of digital conversion values of an analog circuit produced from a sudden change of external noise or inputs. It has two methods of S/W and H/W filters.

■ Precision: The maximum deviation of the ideal output voltage and current against the pre-output range. With respect to the inputs, it is expressed as the maximum difference between the ideal value in the whole input range and the digital conversion value of the input signals. It is mainly expressed in percentage to the full scale. The error includes the gain, offset and linearity errors.

■ Output precision: The difference between an real analog output voltage/current value and ideal conversion value on the graph. It is expressed against the full scale, and the error includes the gain, offset and drift factor. It is expressed respectively in room temperature (25℃) and use temperature ranges.

Appendix 2 Dimension

(1) Dimension of XGF-AH6A



Warranty

1. Warranty Period

The product you purchased will be guaranteed for 18 months from the date of manufacturing.

2. Scope of Warranty

Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

(1) Any trouble attributable to unreasonable condition, environment or handling otherwise specified in the manual,
(2) Any trouble attributable to others' products,
(3) If the product is modified or repaired in any other place not designated by the company,
(4) Due to unintended purposes
(5) Owing to the reasons unexpected at the level of the contemporary science and technology when delivered.
(6) Not attributable to the company; for instance, natural disasters or fire

3. Since the above warranty is limited to PLC unit only, make sure to use the product considering the safety for system configuration or applications.

Environmental Policy

LS Industrial Systems Co., Ltd supports and observes the environmental policy as below.

Environmental Management

LS Industrial Systems considers the environmental preservation as the preferential management subject and every staff of LS Industrial Systems use the reasonable endeavors for the pleasurably environmental preservation of the earth.

About Disposal

LS Industrial Systems' PLC unit is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin (cover) from the product as they are reusable.

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